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PALMERTON ZINC SUPERFUND SITE
OPERABLE UNIT #3, COMMUNITY SOILS
PALMERTON, CARBON COUNTY, PENNSYLVANIA

RECORD of DECISION

TABLE OF CONTENTS

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OPERABLE UNIT #3, COMMUNITY SOILS

DECISION SUMMARY

I. SITE NAME, LOCATION, AND DESCRIPTION

The Palmerton Zinc Superfund Site, Operable Unit #3, Community Soils ("Site"), consists of the Borough of Palmerton, the Village of Aquashicola, and other residential areas of Lower Towamensing Township exhibiting elevated levels of hazardous substances from the zinc processing activities in Palmerton. The Site is located in Carbon County, Pennsylvania in the vicinity of the Lehigh Gap and is approximately 15 miles north of Allentown, Pennsylvania. Figure 1 is the Site location map. The Palmerton Zinc Pile Site was included on the National Priorities List ("NPL") in 1983 because of the threat to human health and the environment posed by a Cinder Bank waste pile which is approximately 2.5 miles long and covers approximately 200 acres. Further investigation has indicated that elevated levels of heavy metals are prevalent throughout the Palmerton Area.

The Site is located primarily in a narrow valley bounded by two ridges; Blue Mountain to the south and Stony Ridge to the north. The two zinc smelting facilities at the Site were known as the East Plant and West Plant. These facilities historically smelted zinc although other metal processing activities are conducted at the East Plant. The Borough of Palmerton is located between the two facilities and the rural residential communities of Lower Towamensing Township (e.g., the Village of Aquashicola) lie primarily east of the former zinc smelting facilities.

The United States Environmental Protection Agency ("EPA") divided the Superfund Site into four Operable Units ("OUs") because of its size and complexity. Operable Unit #1 ("OU #1") addresses re-vegetation of approximately 2,000 acres of denuded non-residential land on the north face of Blue Mountain. A Record of Decision ("ROD") was issued on September 4, 1987, for OU #1. The selected alternative called for the application of a sludge/lime/fly ash mixture to the mountainside and to re-vegetate using grass seed and tree seed. Grass cover has been established on approximately 1,000 acres of Blue Mountain, with approximately 1,000 acres remaining to be re-vegetated. Operable Unit #2 ("OU #2") consists of remediation of the Cinder Bank. The Cinder Bank is primarily a smoldering residue pile from the zinc smelting operations which lies adjacent to the East Plant and along the base of Blue Mountain. The Cinder Bank waste pile is approximately 2.5 miles long and covers approximately 200 acres. A ROD for OU #2 was issued on June 29, 1988. Until recently, no significant work had been completed on the Cinder Bank. However, over the past two years construction activities have progressed toward diverting surface water from Blue Mountain around the Cinder Bank;

collecting and treating leachate coming from the Cinder Bank; and re-vegetating the Cinder Bank. This construction work on the Cinder Bank is expected to be completed in 2002. Operable Unit #4 ("OU #4") concerns an area-wide investigation of contamination in the ground and surface waters and includes an Ecological Risk Assessment. A Remedial Investigation ("RI") of this OU is underway and the Ecological Risk Assessment has been completed. Operable Unit #3 ("OU #3") is the subject of this ROD and consists of remediation of residential soils and interior house dust exhibiting elevated levels of lead, which are a result of historic zinc processing operations.

II. SITE HISTORY AND ENFORCEMENT ACTIVITY

Two former zinc smelters are located separately on east and west sides of the Lehigh Gap where the Aquashicola Creek joins with the Lehigh River. The East Plant is at the eastern end of the Borough of Palmerton, located on the southern side of Aquaschicola Creek at the foot of Blue Mountain. A smoldering residue pile known as the Cinder Bank lies adjacent to the East Plant and along the base of Blue Mountain. The Cinder Bank waste pile is approximately 2.5 miles long and covers approximately 200 acres. The West Plant is located in the western end of the Borough on the northern bank of the Lehigh River.

Both the East and West Plants were formerly operated by the New Jersey Zinc Company. During smelter operations, large amounts of lead, cadmium, zinc, and arsenic were emitted as dust and particulate fallout from stack emissions. Primary zinc smelting was discontinued in 1981. The West Plant is currently not active. Waste from the smelters make up the Cinder Bank. Currently an electric arc furnace ("EAF") dust processing operation is ongoing in the East Plant.

The Palmerton Zinc Pile Site was included on the NPL in September 1983 because of the threat to human health and the environment posed by the Cinder Bank. Further investigation has indicated that elevated levels of heavy metals are prevalent throughout the Palmerton Area.

As stated above, EPA divided the Superfund Site into four OUs. OU #1 addresses the re-vegetation of the north face of Blue Mountain. Grass cover has been established on approximately 1,000 acres of Blue Mountain through the efforts of one of the Potentially Responsible Parties ("PRPs") for the Site pursuant to a Consent Decree. The approximately 1,000 acres remaining is currently being re-vegetated by the other PRP for the Site pursuant to a Unilateral Administrative Order ("UAO"). OU #2 consists of remediation of the Cinder Bank. Until recently, no significant work had been completed on the Cinder Bank. However, one of the PRPs for the Site is in the process of implementing a remediation plan for the leachate generated by the Cinder Bank. Over the past two years construction activities have progressed towards diverting surface water from Blue Mountain around the Cinder Bank; collecting and treating leachate coming from the Cinder Bank; and re-vegetating the Cinder Bank. This construction work on the Cinder Bank is expected to be completed in 2002. OU #4 concerns an area-wide investigation of contamination in the ground and surface waters and includes a Site-wide Ecological Risk Assessment. A Remedial Investigation ("RI") of this OU is underway and the

Ecological Risk Assessment has been completed. Operable Unit #3 (OU #3) is the subject of this ROD.

In September 1985, EPA entered into an Administrative Order on Consent with Horsehead Industries, Inc. and its Division, The New Jersey Zinc Company("HII"), a current owner/operator of the Site, and Gulf and Western Industries, Inc., a former owner/operator of the Site. Under the terms of that agreement HII agreed to conduct a Remedial Investigation/Feasibility Study ("RI/FS") for OU #2, and Gulf and Western Industries, Inc. agreed to conduct a RI/FS for OU #3. A draft RI and Risk Assessment ("RA") for OU #3 was completed in 1988 and revised in 1994. The RI and RA were deemed deficient by EPA and EPA took over the RI/FS and RA for this OU.

In February 1991, the Pennsylvania Department of Environmental Resources ("PADER"), now known as the Pennsylvania Department of Environmental Protection ("PADEP"), sampled dusts in two houses in Palmerton. The results of these samples indicated high levels of lead, cadmium, and zinc. At the request of PADEP, EPA conducted additional sampling at 24 homes in Palmerton. The sampling results from the additional 24 homes correlated with PADEP results. At that time, HII agreed to conduct an interior cleanup of the homes and EPA amended the 1985 Administrative Order on Consent with HII. HII completed the cleanup activities in Spring 1992. EPA also issued a UAO to Paramount Communications, Inc. (formerly Gulf and Western Industries, Inc., now known as Viacom International Inc.) to undertake an extent-of-contamination study to determine the possibility of additional contaminated households. The activities required by EPA in the UAO issued to Paramount Communications, Inc. were performed; but because so few residents would allow sampling on their properties, the study did not, in EPA's opinion, fully define the environmental contamination of the residential communities.

In October 1991, EPA conducted a comprehensive environmental sampling program in Palmerton in conjunction with the Agency for Toxic Substances and Disease Registry ("ATSDR") health testing program. Analytical results were received by EPA in October 1992. Those results showed elevated levels of lead, cadmium, and zinc in surface soils and in household dust. In January and February of 1993, EPA received additional results and reviewed the population make-up in the areas sampled. Based on the sample results, and the make-up of the receptor population, the EPA Remedial Project Manager ("RPM") requested EPA removal assistance to mitigate immediate threats to human health, welfare, and the environment posed by the presence of high levels of contamination in residential areas. The EPA On Scene Coordinator ("OSC") deemed that Removal Activities were necessary to mitigate threats to public health posed by the Site.

A. SUMMARY OF EPA INTERIM REMOVAL ACTION

EPA initiated Interim Removal Activities in April 1994. Residents were notified of the program and were provided the information necessary for them to initiate discussions with the OSC regarding their potential eligibility for cleanup. The OSC provided the residents with a cleanup questionnaire requesting information on ownership of the residence and the ages of children at the residence. EPA's contractor then collected samples from the dust and soil for analysis. The results of the soil/dust analysis and the ages of the children at the residence were factored into the OSC's determination of the eligibility for cleanup.

The following table shows the number of houses cleaned and sampled each year during the Interim Removal Action. Because of cold temperatures in northeast Pennsylvania during the Winter months, cleanup activities were temporarily halted in the Winter each year and resumed in the Spring.

YEAR	HOMES SAMPLED		HOMES CLEANED	
	NEW	RESAMPLED	INTERIOR	EXTERIOR
1994	100		22	21
1995	118	3	44	35
1996	137	12	28	86
1997	83	6	22	53
TOTALS	438	21	116	195

A total of 438 houses were sampled during the four year period covering the Interim Removal Action. The sampling showed the presence of high levels of lead and cadmium in soils and in household dusts which required immediate removal.

A total of 202 houses were cleaned during the four year period, of which 116 were cleaned on the interior (including, High Efficiency Particulate Arresting ("HEPA") vacuuming and carpet removal/replacement) and 195 were cleaned on the exterior (excavation of upper 2 inches of most contaminated soil and tilling in of agricultural amendments or clean top soil). Seven houses were cleaned on the interior only and 86 houses were cleaned on the exterior only. At the conclusion of the cleanup activities in 1997, EPA provided each homeowner whose home was cleaned with a package containing: a) EPA publication "Protect Your Family From Lead in Your Home"; b) one Instant Lead Testing kit for detection of lead on any surface; c) a brochure "Things You Can Do To Prevent Lead Poisoning"; and d) brochures with information on free blood-lead screening and residential lead paint abatement programs.

B. SUMMARY OF NEIGHBOR HELPING NEIGHBOR

The Neighbor-Helping-Neighbor Program ("NHN") is a voluntary program established by the Zinc Corporation of America in 1991. The NHN program objective is to assist Palmerton residents in establishing and/or maintaining vegetation on their properties. Offered as a free program available to all landowners in and near Palmerton, the NHN program consists of soil tests/analyses, site specific recommendations, free soil amendments (mushroom composts, limestone, fertilizer, and grass seed) and ongoing technical consulting. Since its inception in 1991, over 1,100 residential landowners in Palmerton have signed up for the NHN program through 1998.

Although one component of the NHN program consists of soil test/analyses, these analyses do not measure soil contaminant concentrations. The purpose of this program is to provide advice on fertilizer application and re-seeding rather than to reduce soil contamination. However, participation in the program may have resulted in dilution of contamination. A recent exposure study in Palmerton found that participation in the NHN Program may have resulted in some reduction in soil lead concentrations in residential yards (University of Cincinnati, 1996). However, because of the lack of soil contaminant concentration analysis prior to application of the NHN Program, quantifying the reduction in concentration is difficult. Other efforts which have/may have resulted in increased ground cover and/or dilution of soil contaminants have also been undertaken formally (e.g., EPA's Interim Removal Action, described above) and informally (individual homeowners covering/replacing soil exclusive of NHN).

III. HIGHLIGHTS OF COMMUNITY PARTICIPATION

The OU #3 ***Baseline Risk Assessment ("BRA")*** was prepared by EPA with unprecedented participation throughout the process by concerned citizen groups and potentially responsible parties. A risk assessment sub-committee was formed and included members of concerned citizens groups in the Palmerton area, potentially responsible parties, EPA, and PADEP. The risk assessment sub-committee met regularly throughout the three year preparation of the risk assessment to discuss issues and comments received by EPA. This inclusiveness of stakeholders in the OU #3 risk assessment process by EPA was unprecedented. The goal of this inclusiveness was to generate a baseline risk assessment that everyone could accept even if everyone could not agree with every detail.

EPA representatives also made themselves available to provide updates on the status of OU #3 and to answer questions and concerns of citizens throughout the OU #3 process. This included attending routine meetings of the Palmerton Environmental Task Force ("PETF") and the Palmerton Citizens for a Clean Environment ("PCCE").

Pursuant to CERCLA § 113(k)(2)(B)(I)-(v), EPA released for public comment the final RI/FS reports and the Proposed Remedial Action Plan ("Proposed Plan") setting forth EPA's preferred alternative for OU #3, Community Soils, Palmerton Zinc Superfund Site, on June 5, 2000. EPA made these documents available to the public in the Administrative Record located at the EPA Administrative Record Room in Region III's Philadelphia office, and at the Palmerton Public Library, Palmerton, Pennsylvania. The notice of availability of these documents was published in the *Lehighton Times News* and the *Allentown Morning Call* on June 5, 2000.

Typically, a 30 day public comment period follows the release of an EPA Proposed Plan. In recognition of expected heightened community interest, EPA established a 60 day comment period for the Proposed Plan for OU #3, from June 5, 2000, to August 3, 2000. The comment period included a public meeting on June 28, 2000, at which EPA presented the proposed preferred alternative, answered questions, and accepted oral and written comments. The meeting was held at the following location:

Palmerton Fire House
855 Princeton Avenue
Palmerton, PA 18071

The meeting was attended by over 200 people and was conducted from 7:00 pm until everyone who wished to speak had an opportunity to speak on the record. The meeting was concluded at approximately 10:00 pm.

After the public meeting and during the 60 day public comment period, EPA received a timely request for a 30 day extension of the public comment period due to the complexity of OU #3. After evaluating the request, EPA granted the request for an extension of the comment period to September 2, 2000.

Following the conclusion of the comment period on the Proposed Plan, this ROD, including a Responsiveness Summary, was prepared. The Responsiveness Summary, which is Appendix D to this ROD, summarizes the significant comments on EPA's Preferred Remedial Alternative and provides EPA's responses to those comments. This ROD also reflects changes made in response to comments. Those changes are more fully discussed in Section XI below and in the Responsiveness Summary. Copies of this ROD and Responsiveness Summary are available for public review in the information repositories.

Detailed information on the material discussed herein may be found in the Administrative Record for the Site which contains the RI (CDM Federal Programs Corporation Trip Report), FS, BRA, and other information used by EPA in the decision-making process, including how the Site-specific cleanup standard of 650 ppm was determined . EPA encourages the public to review the Administrative Record in order to gain a more comprehensive understanding of the Site and Superfund activities that have been conducted there. The locations of the Administrative Record file for the Site are:

Palmerton Public Library
402 Delaware Avenue
Palmerton, PA 18071
Contact: Gerald Geiger
(610) 826-3424

A copy of the Administrative Record file is also available at EPA Region III Offices. For an appointment contact:

Anna Butch
Administrative Record Coordinator
U.S. Environmental Protection Agency, Region III
1650 Arch Street
Philadelphia, PA 19103 - 2029
(215) 814-3157

IV. SCOPE AND ROLE OF THE RESPONSE ACTION

The Selected Remedy described in this ROD will address the threats posed by the release of hazardous substances, including lead, cadmium, and arsenic, at the Palmerton Zinc Superfund Site, Operable Unit #3, Community Soils. Operable Unit #3 consists of areas in the Borough of Palmerton, the Village of Aquashicola, and other residential areas of Lower Towamensing Township exhibiting elevated levels of hazardous substances from the zinc processing activities in Palmerton. The Palmerton Site OU #3 boundaries are defined as the Bowmanstown municipal boundary to the west, Fireline and Hahns Dairy Road to the north, the Lehigh River and Aquashicola Creek to the south, and the area east to the fork in Little Gap Road. The Site includes all properties which are found to exhibit levels of lead contamination in exterior soils greater than an average 650 parts per million ("ppm") as determined by composite sampling. Approximate OU #3 boundaries and other Site features are shown on Figure 1 in Appendix A. EPA, in consultation with PADEP, will evaluate the results of eligibility sampling during remedial action implementation to determine if it is appropriate to adjust the OU #3 eligibility boundaries. Criteria to be used to adjust the OU #3 eligibility boundaries will be determined during remedial design and will be approved by EPA, in consultation with PADEP.

This ROD for OU #3 at the Site will meet the following Remedial Action Objectives:

prevent ingestion of contaminated residential soil and/or indoor dust by reducing contaminant concentrations in these media and/or creating a vegetative barrier to the soils to reduce exposure and therefore reduce risk at each residence to acceptable levels;

in addition, preference will be given toward utilizing permanent remedial alternatives which will provide the greatest long term protectiveness, whenever practicable, thereby avoiding institutional controls to the extent practicable.

EPA will solicit and encourage participation of all residential property owners within the OU #3 boundaries during eligibility sampling to ensure protectiveness and to minimize re-contamination. EPA is establishing a goal for participation in the remedial action of a minimum of 80% of those found to be eligible for remediation. If these remedial goals are not met during the remedial action, EPA, in consultation with PADEP, will reevaluate the protectiveness of the selected remedy. In evaluating these goals, EPA will take into consideration the sampling and cleanup work conducted under the EPA Interim Removal Action.

Because children are thought to be most susceptible to the adverse effects of lead, protection for this age group is assumed also to protect older individuals. Protection of young children will be achieved if, following implementation of the selected remedy or contingent remedy, exposure is reduced such that a typical or hypothetical child or group of similarly exposed children would have an estimated risk of no more than 5 percent exceeding the 10ug/dL blood-lead level, which represents the standard established by ATSDR and EPA.

V. SUMMARY OF SITE CHARACTERISTICS AND EXTENT OF CONTAMINATION

A. Site Characteristics

1. Topography and Climate

The Site is located in the Appalachian Mountain section of the Valley and Ridge physiographic province, which is characterized by parallel and subparallel ridges and valleys trending roughly northeast to southwest. This type of topography results from the differential erosion by both chemical and physical weathering of tectonically folded rocks. Formations such as sandstones and conglomerates, which are relatively resistant to weathering, form the ridges of Blue Mountain and Stony Ridge. Shales, and in some cases limestones, which are much less resistant to erosion, form the valley bottoms. Elevations of valley bottoms in this area range between 400 to 500 feet above sea level and ridge top elevations range from 600 to 700 feet above sea level on Stony Ridge to greater than 1500 feet above sea level on Blue Mountain.

A humid, middle latitude, continental climate prevails in the area of the Site. This type of climate results from repeated invasions and interactions of tropical and polar air masses. The normal successions of high and low pressure systems moving eastward across the United States produce weather changes in the area every few days in the Winter and Spring and less frequently during the Summer and Fall. The presence of numerous mountains, ridges, and valleys can cause variations in local climate, such as the amount of rainfall, due to storm deflections. Precipitation data suggests that Blue Mountain has a rain-shadow effect on precipitation received by Palmerton, as it is not unusual for Palmerton to receive 5 to 7 inches less rain per year than towns located a little farther north. Rainfall is normally plentiful all year but highest in the Summer when tropical air masses dominate.

2. Demography and Land Use

The Site area is predominantly comprised of rural and semi-rural areas in the southern portion of Carbon County, Pennsylvania. Based on U.S. Census data estimates, Palmerton Borough has a population of 5,289 and the men to women ratio is nearly 100:109. The Borough of Palmerton consists of approximately 2,177 households and 1,509 families. Additionally, an estimated 581 households lie outside the Borough limits but within the area covered by OU#3.

3. Soils

Soils along the Aquashicola Creek flood plain are deep soils on glacial outwash derived from grey and red rocks. Soils in the valley outside of the Aquashicola Creek flood plain are colluvium found along the base of steep mountains of the Laidig Buchanan Association.

The Laidig soil series (LaB2, LaC2, LaD3, LdD, and LdB) consist of deep, well-drained, yellowish-brown to reddish-yellow soils that have a hardpan at a depth of about 34 inches. These soils were formed on colluvial slopes at the bases of steep mountains. Their parent material was weathered from a mixture of gray and red sandstone, conglomerate, siltstone, and shale.

The Buchanan soil series (BcB2, BhB, and BhD) consists of deep, moderately well-drained to somewhat poorly-drained soils that have a yellowish-brown to strong-brown surface layer. The subsoil is yellowish-brown to dark brown and is somewhat mottled. A hardpan that is 5 to 18 inches thick is at a depth of 20 to 24 inches. The Buchanan soils have formed in colluvium that originated from mixed grayish and reddish sandstone, shale, siltstone, and conglomerate. They occupy the less well-drained lower slopes at the bases of steep mountains.

B. Nature and Extent of Contamination

The primary emphasis for OU #3 has been on surficial soils in residential yards and household interior dusts. This is the result of past studies at the Site showing contaminated soils and dusts as the major media contributing to human health risks.

A summary detailing which data were used in the BRA and what they were used for is presented below and in Table 1, Appendix B.

1. CDM FEDERAL PROGRAMS CORPORATION DATA SET - FALL 1991

In the Fall of 1991, EPA directed CDM Federal Programs Corporation ("CDM"), an EPA contractor, to collect soil, dust, and water for analysis in conjunction with a health study being conducted by ATSDR. The results of the CDM data collection effort are presented in Palmerton Zinc Site Final Field Trip Report, prepared by CDM Federal Programs Corporation for EPA, dated December 1993. The CDM Field Trip Report served as the RI for this OU and is part of the Administrative Record for OU #3. As part of this sampling event, CDM collected soil, dust, and water samples from 193 residences in Palmerton in the vicinity of the zinc smelting facility and from 125 residences in Jim Thorpe, Pennsylvania. Residences were sampled if consent was obtained following random selection of the residence for participation in the study by ATSDR. Some residents who participated in the ATSDR study refused participation in the study conducted by CDM. Eighty-one percent of the residents in the Borough of Palmerton and 72 percent of the residents in Jim Thorpe who participated in the ATSDR study also participated in CDM's study.

During the 1991 sampling event, the following media were sampled: soil, house dust, street dust, exterior entryway dust, and tap water. Surface soil samples were collected from vegetable gardens, sandbox/play areas, bare areas, perimeter soil, and areas facing the zinc smelting facility. Not all types of soil samples were collected at all residences.

Dust samples were collected from three locations: inside the home, immediately outside the home, and in the adjacent street. Exterior dust samples were a composite from the front and back or side entrances. Street samples were a composite of several samples collected at the juncture of the street and the curb, where soil and dust usually collect. Interior dust samples were composites of dust in the entryway, the most utilized room, and the child's room.

Environmental samples were analyzed for lead, cadmium, zinc, and arsenic. Samples were analyzed by EPA Contract Lab Program Laboratories and the resultant data were validated by EPA Region III Central Regional Laboratory personnel. The data set collected by CDM represents one of the most comprehensive sampling events conducted at the Site to date. The data were therefore used for quantitative risk assessment for people living in the Borough of Palmerton. The data were used to evaluate exposure to arsenic, cadmium, lead, and zinc. Only data collected within the Borough of Palmerton were used; data collected outside of the Borough (e.g., in Jim Thorpe) were not included.

2. ATSDR DATA SET

ATSDR conducted a health study in Palmerton and nearby Jim Thorpe in 1991 (ATSDR 1991). The purpose of the study was to evaluate blood-lead and urinary-cadmium levels in a randomly selected group of residents in the Borough of Palmerton. Blood-lead and urinary-cadmium levels were measured in 108 children younger than 72 months.

The data from the ATSDR study were used qualitatively but not quantitatively in the BRA for several reasons. First, data available for use in the BRA are based on a data set reduced from the original 108 (i.e., 34 individuals, perhaps 12 percent of the under 72 month population [University of Cincinnati, 1996]) and may not be representative for the Borough as a whole. Second, the data are relatively old and newer, more comprehensive data are available (See University of Cincinnati data set). Blood-lead data from the ATSDR study were used for comparative purposes in the BRA.

3. UNIVERSITY OF CINCINNATI DATA SET - NOVEMBER 1994

The University of Cincinnati ("U of C") conducted a lead exposure study in the Borough of Palmerton in October and November 1994. The main purpose of the study was to evaluate exposure to lead in young children. All families with children less than 72 months living within the Borough were targeted for inclusion in the study. To elicit participation in the study, homes in the Borough were divided into three groups: (1) homes where children under 72 months were known to reside, (2) homes with children whose ages were unknown, and (3) homes not believed to include children under 72 months. The first two groups were targeted for 100 percent door-to-door census and received personal letters asking for participation. In addition, ads were put in the local newspaper to request participation in the study. Of 287 children under 72 months identified in a census, 140 (49 percent) participated in the study.

Blood-lead samples were collected from 140 children under the age of 72 months in October 1994, and soil and interior dust samples were collected from the homes of these children in November 1994. Soil samples were collected from the perimeter of participating homes at a distance of 3 feet from the foundation. The interior surface dust sample consisted of a composite of at least three sub-samples taken from the following areas in the residence:

- An interior floor area near the most frequently used entrance,
- A floor area in the room most utilized by the subject child, and
- A floor area in the subject child's bedroom.

Occasionally, additional sub-samples were added to the composite samples. These sub-samples were taken from bedrooms occupied by additional subject children or at additional frequently used entrances. If there was only a very small amount of dust in the cassette of the air monitoring pump, the sample process was repeated on other, untouched floor samples, using the same filter. Total area sampled was recorded to allow accurate calculation of dust loading.

Soil and dust samples were analyzed for lead using x-ray fluorescence ("XRF") instruments without confirmatory sample analysis by wet chemistry methods (e.g., atomic absorption ("AA") and inductively coupled plasma ("ICP")). Results of the analyses of samples collected by U of C and additional details regarding sampling and analysis protocols are presented in "Palmerton Lead Exposure Study," prepared by the U of C for the PETF and dated October 1996. Split samples were provided to EPA's National Enforcement Investigations Center ("NEIC") by the U of C during the November sampling event. These samples were analyzed using standard wet chemical methods by the NEIC laboratory in Denver, Colorado. EPA Region III's Central Regional Laboratory performed a comparison of field data to confirmatory laboratory analytical data and determined that the XRF data were generally of adequate quality for use in the BRA.

The U of C data were used to assist in evaluation of exposures to lead. Since the blood-lead data were collected at the same locations and at the same time as environmental data, they provide a baseline against which predicted values (i.e., via the Integrated Exposure Uptake Biokinetic ("IEUBK") Model) can be compared. Coordinates for the locations of samples taken by U of C are not available due to concerns for confidentiality. Therefore, although data from each individual residence is available, these data cannot be associated with specific residences. Distributions of lead in soil and house dust in the U of C study and estimates of lead exposure made from these estimates are compared using the data without spatial information. However, no spatial comparisons with predictions made from the CDM data set are possible.

4. OAK RIDGE NATIONAL LABORATORY ("ORNL") DATA SET - 1988

In 1988, the ORNL collected data at the Site of the former uranium storage area on a portion of the East Plant. The data collected provided the basis for a radiation dose assessment prepared by Argonne National Laboratory in February 1991. These data were used in the BRA to screen potential exposures to residual uranium ore. These data are not current and are not considered adequate for a full quantitative evaluation of potential uranium-related risks.

5. PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL PROTECTION ("PADEP") AIR DATA SET - 1990 TO 1995

PADEP has monitored air in the Borough of Palmerton since at least late 1990. Two data sets were available for use in the BRA. The first consists of results of analyses from single monitors in Aquashicola and Palmerton and contains data for arsenic, cadmium, lead, and zinc, as well as several other metals, total suspended particulates ("TSP"), chloride, sulfate, and benzo(a)pyrene. The second data set consists of sample results from several monitors placed at the Aquashicola site, and includes data on arsenic, cadmium, lead, zinc, and TSP, as well as a more modest list of other metals. The data set has samples for most days in 1995, although not for all monitor types.

Data from 1990 through 1995 were used in the BRA to help establish trends in air concentrations in recent years. Only the most recent data (data from 1995) were used in

screening analyses to examine the potential impact of inhalation exposures on people living within the OU #3 boundaries.

6. INTERIM REMOVAL ACTION DATA SET - SPRING 1994 through FALL 1997

Beginning in the Spring of 1994 and continuing through the Fall of 1997, EPA collected over 200 residential samples from over 70 properties in preparation for an Interim Removal Action. EPA collected soil and dust samples using sampling procedures somewhat similar to those used during the Fall 1991 sampling event. However, perimeter soil samples were not collected and dust was collected with a large vacuum designed for deep-cleaning. Samples were analyzed for lead, cadmium, and zinc. These data were not used in the BRA because sampling occurred at homes thought to be "at risk," introducing a likely high bias. Since two other comprehensive data sets are available (CDM data set and U of C data set), data collected during the Interim Removal Action are not considered critical to the evaluation of risks within the OU #3 boundaries. However, samples were collected during the Interim Removal Action from a number of homes also sampled by CDM in 1991. Comparison of paired data from the same locations over a three to four year time frame is thus possible for a limited number of homes. These comparisons form the basis for an analysis of trends in concentrations of cadmium, lead, and zinc in soils over time (Smith 1996).

7. U OF C MULTI-METALS STUDY

The U of C collected soil samples from approximately 95 locations (homes) in 1994 to provide data that could be used to determine which metals and other inorganics found in soil could be attributed to airborne releases from the smelter. These data have not been validated and are not suitable for use in a quantitative risk assessment. However, general relationships among analytes are useful in assessing Chemicals of Potential Concern ("COPCs").

8. OTHER ENVIRONMENTAL DATA

A source identification study was conducted by NEIC. This study is not included in COPC selection since additional source identification data were not needed in the BRA. Source allocation is not considered in the BRA except in support of selection of COPCs.

Other environmental data have been collected over a period of several years. These data are not used in the BRA for a variety of reasons.

9. SUMMARY OF CDM DATA SET

The primary contaminant migration mechanism was airborne deposition of zinc and other metals released from stack and fugitive emissions during the zinc smelting activities and airborne deposition from EAF dust processing activities. Measured concentration ranges for residential yard soil contaminants are presented in Table 1, Appendix B. Data from the residential yard samples show surficial soil concentrations of lead as high as 10,600 mg/kg. Some initial soil survey data in and around Palmerton was analyzed by depth. These analyses indicated that contaminants of concern are concentrated in the surface soils. The soil cores examined went to a depth of 30 centimeters ("cm"), and results showed that concentration drops rapidly over the top 7.5 cm (2.5 inches) and less rapidly over the remainder of the 30 cm. Dust sampling results of samples collected as part of the CDM sampling event are summarized in Table 2, Appendix B. The dust sampling results indicate that interior dust concentrations of lead, arsenic, and cadmium were as high as 6,400 mg/kg, 199 mg/kg, and 266 mg/kg, respectively.

VI. SUMMARY OF SITE RISKS

As discussed in detail above, the OU #3 BRA was prepared by EPA with unprecedented participation of concerned citizen groups and potentially responsible parties throughout the process. The BRA focused exclusively on OU #3 using data collected during past field investigations for this OU, air quality data collected by PADEP, data from an exposure study for lead conducted by the U of C, and data collected by ORNL regarding the uranium storage area. Results from environmental sampling efforts indicate that elevated levels of metals are present in soils at the Site. The results of those sampling efforts are documented in CDM's Field Trip Report.

The BRA uses data from both the CDM sampling event in 1991 and the U of C sampling event in 1994 in developing the assessment of risks to residents of the Borough of Palmerton and surrounding areas. The goals of the BRA were to determine if further remedial action is required and to serve as the basis for assessing cleanup goals for any such action.

A. Human Health Risk Evaluation

1. Selection of Chemicals of Potential Concern

Arsenic, cadmium, lead, and zinc are the only analytes in the CDM data set from the Fall of 1991. Only lead results are available from the 1994 U of C sampling event. Because the list of analytes is so small, it was not considered necessary to reduce the list of COPCs via chemical toxicity screening. Therefore, arsenic, cadmium, lead, and zinc are all considered COPCs.

2. Exposure Assessment

The objective of the exposure assessment is to estimate the amount of each chemical of potential concern at a site that is actually taken into the body (i.e., the intake level or dose). There are three primary routes through which individuals may be exposed to Site related contaminants: incidental ingestion, inhalation, and dermal contact. Receptors can be either directly or indirectly exposed to Site related contaminants via the environmental media

addressed in the Remedial Investigation -- groundwater, surface water, air, soil, sediment, leachate, and air.

Carcinogenic risks are calculated as an incremental lifetime risk, and therefore incorporate terms to represent the exposure duration (years) over the course of a lifetime (70 years, or 25,550 days). Noncarcinogenic risks are calculated using the concept of an average annual exposure. The following is a discussion of the potential human exposure routes at the Site which were evaluated in the BRA.

Current and likely future land-use within the Borough of Palmerton and surrounding areas is the primary consideration for identification of populations and pathways for quantitative evaluation. Populations that may be exposed to contaminants from the Site include current and future residents, current and future workers at commercial establishments within the Borough and surrounding areas, and current and future recreational visitors. Occupational exposures of workers at the East Plant are outside the scope of this assessment. Worker health and safety are the responsibility of the state and federal Occupational Health and Safety Administrations ("OSHA"). The population likely to receive the highest exposures consists of year-round residents of Palmerton and surrounding areas. Since Palmerton is largely residential, it is reasonable to assume that remediation, if any, within the Borough and surrounding areas should be based on residential exposures. Thus, the emphasis of the assessment is on residents of Palmerton and surrounding areas.

The following exposure pathways appear likely to account for the bulk of potential contact with contaminated media:

- Inhalation of contaminants in ambient air
- Incidental ingestion of contaminated soil
- Incidental ingestion of contaminated indoor dust
- Ingestion of garden vegetables grown in contaminated soil
- Ingestion of livestock and dairy products raised on contaminated land
- Dermal contact with contaminated soils and dusts

These pathways are the focus of the pathway analysis. In addition, potential background exposures from ingestion of lead in tap water are evaluated. The model used to evaluate exposure to lead includes tap water as a source of background exposures. A summary of the pathways analysis is provided in Table 3-1 of the BRA, which is in the Administrative Record for OU #3.

EXPOSURE ASSUMPTIONS

The following calculations and evaluations can also be found in the BRA which is part of the Administrative Record for OU#3, pages 3-16 through 3-26.

METHODS USED TO CALCULATE CHEMICAL INTAKES FOR ARSENIC AND ZINC

Ingestion of Soil and Dust

Chronic daily intakes ("CDIs") from ingestion of soil and dust are calculated using the following formula:

$$\textbf{Intake (mg/kg day)} = \frac{((C_s \times F_s) + (C_d \times F_d)) \times CF \times IR_{sd} \times ED \times EF}{AT \times BW}$$

where: C_s = Chemical concentration in soil (mg/kg)
F_s = Fraction of ingested material from soil
C_d = Chemical concentration in indoor dust (mg/kg)
F_d = Fraction of ingested material from indoor dust

CF	=	Conversion factor (10^{-6} kg/mg)
IR_{sd}	=	Ingestion rate for soil and indoor dust (mg/day)
ED	=	Exposure duration (years)
EF	=	Exposure frequency (days/year)
BW	=	Body weight (kg)
AT	=	Averaging time (days)

Dermal Absorption from Soil

CDIs from dermal absorption of chemicals in soil are calculated using the following formula:

$$\textbf{Intake (mg/kg day)} = \frac{C_s \times CF \times SA \times AF \times ABS \times EF \times ED}{AT \times BW}$$

where: SA	=	Skin surface area available for contact (cm^2/event)
AF	=	Soil to skin adherence factor (mg/cm^2)
ABS	=	Absorption factor (unitless)

All other parameters are defined above.

Inhalation of Ambient Air

CDIs from inhalation of chemicals in ambient air are calculated using the following formula:

$$\textbf{Intake (mg/kg day)} = \frac{C_{air} \times IR \times EF \times ED}{AT \times BW}$$

where: C_{air}	=	Concentration in air (mg/m^3)
IR	=	Inhalation rate (m^3/day)

All other parameters are defined above.

Ingestion of Garden Vegetables

CDIs from ingestion of garden vegetables are calculated using the following formula:

$$\textbf{Intake (mg/kg day)} = \frac{C_v \times IR_v \times CF \times EF \times ED \times FI}{AT \times BW}$$

where: C_v	=	Concentration in vegetables (mg/kg)

IR_v	=	Vegetable ingestion rate (mg/day)
FI	=	Fraction of homegrown vegetables ingested

All other parameters are defined above.

CDIs are calculated separately for carcinogenic and noncarcinogenic exposures.

METHODS USED TO EVALUATE EXPOSURE TO CADMIUM

The reference dose ("RfD") for cadmium is based on a simple pharmacokinetic expression for accumulation of cadmium in the kidney. The RfD actually represents an estimate of the daily exposure to cadmium that would result in a kidney concentration of 200 ug/g wet weight after 50 years of exposure with a safety factor of 10 applied to ensure protection of sensitive individuals. Use of the RfD for shorter periods of exposure may significantly overestimate potential threats from cadmium exposure. For this assessment, an alternative approach is taken where kidney concentrations for cadmium are estimated based on exposure durations representative of the population in Palmerton and surrounding areas. These calculations are made for both cadmium exposure related to environmental contamination in Palmerton and surrounding areas, and for estimated background exposure to cadmium, mainly from dietary sources. The results are expected to be more representative of actual cadmium-related risks than use of the RfD in the standard fashion suggested by EPA (1989a).

METHODS USED TO EVALUATE EXPOSURE TO LEAD

The best available quantitative tool for evaluating health effects from exposure to lead is the IEUBK model (EPA 1994a). This model uses current information on the uptake of lead following exposure from different routes, the distribution of lead among various internal body compartments, and the excretion of lead, to predict impacts of lead exposure on blood-lead concentrations in young children. The predicted blood-lead concentrations can then be compared with target blood-lead concentrations associated with subtle neurological effects in children. Because children are thought to be most susceptible to the adverse effects of lead, protection for this age group is assumed to also protect older individuals. Protection of young children is considered achieved if exposure is such that a typical or hypothetical child or group of similarly exposed children would have an estimated risk of no more than 5 percent of exceeding the 10 ug/dL blood-lead level (EPA 1994a). The IEUBK model (Version 0.99d; EPA 1994a) was used to evaluate potential risks from exposure to lead associated with the Site.

<u>Comparison between Predicted and Observed Blood-lead Levels</u>

The predictions of the IEUBK model are compared to blood-lead concentrations in the community observed during the 1994 U of C study. For these comparisons, environmental data and child ages from the U of C study are used in a batch file for the IEUBK model. Blood-lead levels predicted from this batch file input are then compared to those observed in 1994. Initial model runs suggested that the IEUBK model was significantly overestimating blood-lead levels (Table 3.5, BRA). In essentially every individual case, the model predicted a mean blood-lead concentration significantly higher than that observed. Overall, predictions of blood-lead were about twice the levels of those observed.

Better agreement between observed and predicted blood-lead concentrations was observed when predicted concentrations were compared to those observed in the ATSDR study conducted in Palmerton in 1991. In this comparison, predicted blood-lead levels are also based on data collected by CDM, but only residences for which ATSDR blood-lead data were available were included. Generally, blood-lead measurements from the Borough were interpreted as follows:

> Blood samples collected by the U of C were taken at a time when blood-lead concentrations may have been falling after reaching a peak in late Summer. By October, weather in eastern Pennsylvania will have reduced the number of outdoor play hours, thereby reducing exposure to outdoor soils. Observed blood-lead levels are assumed to underestimate somewhat maximum blood-lead concentrations for the population. Moreover, perimeter soil concentrations measured in the U of C study may overestimate exposure concentrations and therefore underestimate the relationship between soil lead and blood-lead. Blood-lead data collected by ATSDR were probably collected during the time when blood-lead concentrations would reach their peak, but the population of children in the study was small and potentially biased, and the data are sufficiently old that their ability to predict current blood-lead levels is open to question. Generally then, neither exposure study conducted in the Borough is ideal for evaluating the output from the IEUBK model. This assessment assumes that the two studies provide a range of possible peak blood-lead concentrations for the population of young children and the IEUBK model is adjusted keeping the results of both studies in mind.

Adjustments to the IEUBK Model

Differences between observed and predicted blood-lead concentrations are probably too large to be explained solely on the basis of timing of blood sampling, time spent at home, and the programs aimed at dilution of contaminants. The BRA assumed that some factors were overestimated in the IEUBK model run in default mode. An objective adjustment was made, based on the Binder, et al. study (1986), the soil ingestion study, and the range of possible age-specific soil ingestion rates for young children (EPA 1994a). For this adjustment, a default soil ingestion rate of 100 mg/day in the IEUBK model was reduced to the geometric mean soil ingestion rate (84 mg/day) for the Binder, et al. study (1986) (Brainard and Burmaster 1992). Other age-specific default soil ingestion rates were decreased by the same fraction. The resulting age-specific soil ingestion rates range from 53 to 84 mg/day. The top of this range is at the bottom of the range of soil ingestion rates (0 to 135 mg/day) suggested as reasonable age-specific inputs to the IEUBK model (EPA 1994a). The adjustments were therefore consistent with current information on soil ingestion rates and with suggested inputs to the IEUBK model. Further discussion of soil ingestion is included in Section 6.0. of the BRA.

Adjustments to the soil ingestion rates in the model resulted in predicted blood-lead concentrations that were still higher than those observed in the U of C study. The geometric mean of predicted blood-lead concentrations was, however, less than that observed in the ATSDR study. The use of the IEUBK model in this manner is thought to be protective since some allowance was made for limitations in the blood-lead study. Other Site-specific model adjustments included the tap water concentration for lead ("Pb") in the Palmerton public water supply, dietary intake values for Pb, and a geometric standard deviation ("GSD") derived from the U of C study conducted in Palmerton.

3. Toxicity Assessment

The toxicity assessment characterizes the inherent toxicity of a compound and helps to identify the potential health hazard associated with exposure to each of the chemicals of concern. Toxicological values, RfDs for non-carcinogenic chemicals, the non-carcinogenic effects of carcinogens, and cancer slope factors ("CSFs") for known, suspected, and possible human carcinogens derived by EPA were used in the BRA.

The purpose of the toxicity assessment is to examine the potential for each COPC to cause adverse effects in exposed individuals and to describe the relationship between the extent of exposure to a particular contaminant and adverse effects. Adverse effects include both noncarcinogenic (systemic) and carcinogenic health effects in humans.

TOXICITY CRITERIA

Sources of toxicity information include EPA's IRIS, ATSDR, HEAST, and EPA criteria documents. The hierarchy of toxicological information sources used in this BRA was based on EPA guidance (EPA 1989b). Standard sources of toxicity information were not used for the evaluation of lead. Instead, lead was evaluated using the IEUBK Lead Model, Version 0.99d.

For each COPC, a toxicity profile was included based on information from the documents cited above, as well as other recent information from relevant scientific literature. These profiles describe important toxicokinetic findings (absorption into, distribution in, metabolism by, and excretion from the body), outline major adverse effects, discuss uncertainties and important data gaps, and summarize important studies used in the derivation of toxicity values.

Toxicity criteria for carcinogens are slope factors in units of risk per milligram of chemical exposure per kilogram body weight per day $(mg/kg\text{-}day)^{-1}$. These CSFs are based on the assumption that no threshold for carcinogenic effects exists and any dose, no matter how small, is associated with a finite cancer risk. Toxicity values for noncarcinogens, or for significant noncarcinogenic effects caused by carcinogens, are RfDs in units of milligrams of chemical exposure per kilogram body weight per day (mg/kg-day). RfDs are estimates of threshold; exposures less than the RfD are not expected to cause adverse effects even if exposures continue for a lifetime in the most sensitive populations. RfDs have been developed by EPA for indicating the potential for adverse health effects from exposure to chemicals exhibiting noncarcinogenic effects.

CSFs have been developed by EPA's Carcinogenic Assessment Group for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic chemicals. CSFs, which are expressed in units of $(mg/kg\text{-}day)^{-1}$, are multiplied by the estimated intake of a potential carcinogen, in mg/kg-day, to provide an upper-bound estimate of the excess lifetime cancer risk associated with exposure at that intake level. The term "upper-bound" reflects the conservative estimate of the risks calculated from the CSF. Use of this approach makes underestimation of the actual cancer risk highly unlikely. CSFs are derived from the results of human epidemiological studies or chronic animal bioassays to which animal to human extrapolation and uncertainty factors have been applied.

Toxicity criteria (and related parameters) can be found in Table 4.1 (cancer) and Table 4.2 (non-cancer) of the BRA.

TOXICITY ISSUES

Interactions among Cadmium, Lead, and Zinc

EPA (1994b) prepared an extensive review of interactions among cadmium, lead, and zinc reported in the open literature. Available evidence does not support a change in assumed absorption of metals due to interactions among metals following ingestion of contaminated soils. The quantitative risk assessment does not alter the estimates of exposure based on co-exposure to cadmium, lead, and zinc. Further, available information suggests that any potential impact of cadmium on neurotoxicity of lead in young children is largely speculative. No modification to the assessment of lead toxicity is thus justified based on co-exposure to cadmium.

4. Risk Characterization

Carcinogenic risk is presented as the incremental probability of an individual contracting some form of cancer over a lifetime as a result of exposure to the carcinogen. For known or suspected carcinogens, acceptable exposure levels are generally concentration levels that represent an excess upper bound lifetime cancer risk to an individual of between 1.0×10^{-4} (or 1 in 10,000), and 1.0×10^{-6} (or 1 in 1,000,000) using information on the relationship between dose and response. Risk standards for non-carcinogenic compounds are established at acceptable levels and criteria considered protective of human populations from the possible adverse effects from exposure. The ratio of the average daily doses ("ADD") to the RfD values, defined as the

Hazard Quotient ("HQ"), provides an indication of the potential for systemic toxicity to occur. To assess the overall potential for non-carcinogenic effects posed by multiple chemicals, a Hazard Index ("HI") is derived by adding the individual HQs for similar target organs for each chemical of concern. This approach assumes additivity of critical effects of multiple chemicals. EPA considers any HI exceeding one (1) for similar target organs to be an unacceptable risk to human health.

Cumulative Risks and Hazards

The National Oil and Hazardous Substances Pollution Contingency Plan ("NCP") established acceptable levels of carcinogenic risk for Superfund sites ranging from 1 additional cancer case per 10,000 people exposed to 1 additional cancer case per 1 million people exposed if no actions are taken at the Site. Expressed in scientific notation, this translates to an acceptable risk range of between 1×10^{-4} and 1×10^{-6} over a defined period of exposure to contaminants at the Site. In addition to carcinogenic risk, chemical contaminants that are ingested (eaten), inhaled (breathed), or dermally-absorbed (skin contact) may present a non-carcinogenic risk to different organs of the human body. This non-carcinogenic risk or toxic equivalent is expressed as a HQ. A HQ exceeding unity (1) is considered an unacceptable non-carcinogenic risk.

The principal baseline environmental media sources at the Site are contaminated soils and dusts. The most significant health risks are to Palmerton area residents from lead and arsenic in soil and dust. Multiple source and environmental pathways are potentially responsible for these health risks. The BRA identified two major exposure routes as significant and quantitatively evaluated them:

- **Ingestion by residents of contaminated soils** in home yards, and
- **Ingestion by residents of contaminated house dusts** that result from track-in of residential soils and the deposition of airborne particulates.

The BRA identified risk-adjusted, Site-specific remediation goals for contaminants of concern in soils and indoor dust. When achieved, these goals will prevent health risks to residents from metals contaminated soils and indoor dust.

Quantitative risk and hazard estimates for exposure to arsenic, cadmium, lead, and zinc in soils and house dust within the Borough of Palmerton and surrounding areas can be generally summarized as follows:

- Conditions that could result in unacceptable lead exposure are found in most areas of the Borough. These conditions reflect homes where the average of the soil and dust concentrations is 650 ppm or greater. This finding is the basis for establishing a Site-specific lead cleanup standard of 650 ppm.

- Exposure conditions that may result in unacceptable lead exposure are found throughout the Borough. The lack of exact correlation among geographic distributions of lead exposure, lead in soil, and lead in dust underscores the variability in environmental lead concentrations within the Borough. All homes and properties within the OU #3 area will not necessarily have such elevated exposure potential or concentrations. The need for remediation will have to be determined on a house-by-house basis.

- The calculated HQ for cadmium falls mostly below the target of 1. Most exposure to cadmium is due to background intake with Site-related exposures contributing on the average of 10 percent to total cadmium kidney burden. About 15 percent of homes are associated with exposure conditions where cadmium HQs are greater than unity (1). However, exceedances are very small and HQs are expected to increase only very slowly as soil/dust cadmium concentrations increase. Thus, little risk reduction can be realized by reducing soil cadmium levels. Cadmium in soil and dust does not appear to present significant risk and no remediation based on cadmium will be required.

- Exposure to arsenic may result in cancer risks above 1×10^{-5}, but few house-by-house estimates exceed the top of the EPA acceptable risk range (1×10^{-4}). Risk estimates in excess of 10^{-4} are associated with exposure concentrations in soil and/or dust of greater than 100 ppm.

- About 16 percent of HQs for arsenic exposure exceed the target of 1. Possible remediation goals for arsenic based on noncancer effects may be about 79 and 32 ppm for soil and dust, respectively. Areas in the OU#3 area where these concentrations may be exceeded are limited and overlap those where possible lead remediation goals are exceeded.

- Risks due to exposure to zinc are low; no HQs calculated on a house-by-house basis exceed the target index of 1. The assessment for zinc is conservative since it considers exposures to young children who potentially receive the highest exposures.

- Neighborhood risk estimates are not very informative, primarily because of the complex pattern of contamination within the Borough and surrounding areas. It is difficult to define neighborhoods of reasonable size without including some very high concentrations. Moreover, the patterns of contamination do not completely overlap for the four COPCs indicating that neighborhoods defined for one chemical may not be appropriate for others. Because of difficulties in interpretation, neighborhood risks are not used in the interpretation of risks for the Borough and surrounding areas.

A summary of cumulative risks and hazards can be found in various figures in Section 5 of the

BRA and in Table 3, Appendix B of this ROD. Toxicological Profiles are located in Appendix C of the BRA and this ROD.

Reevaluation of BRA based on comments received on Proposed Plan.

As discussed above, an attempt was made to correlate the relationship between contamination in soil and contamination in interior dust in the BRA for OU #3. Since both these media contribute to exposure and, therefore, risk, EPA attempted to use their correlation to aid in the calculation of meaningful remediation goals for lead at the Site. With a slope of 0.22, the lead-specific regression analysis conducted in the BRA revealed a soil-to-dust transfer rate of 22 percent. However, the very high intercept value predicted by this statistical assessment seemed implausible, yielding an artificially low soil remediation goal. (Note that the intercept value theoretically represents baseline lead levels in interior dust.) As a consequence, the results of the regression analysis were abandoned. Instead, the entire CDM analytical data sets for lead in soil and for lead in dust were graphed, with the number of observations plotted against concentration. The two plots overlapped almost exactly, strongly suggesting a 1:1 correlation between lead in soil and lead in interior dust in Palmerton Borough. This assumption resulted in respective cleanup goals of 650 mg/kg for each medium (soil and dust). These remediation

levels were based on the IEUBK Model, as it was applied in the BRA for OU #3. Details of this regression analysis for lead can be found on page 5-23 and in Figure 5-14 of the BRA .

The extreme relative differences in the soil-to-dust transfer rates of other metals associated with the Site versus the coefficient assumed for lead (100 percent) was troubling. This discrepancy among metals prompted Region III to request statistical support from EPA's National Exposure Research Laboratory ("NERL") subsequent to issuance of the Proposed Plan for OU #3 . After discarding obvious outliers from the data set -- that is, interior dust levels greater than 1000 mg/kg *and* at least twice the observed soil concentrations for a given property -- a regression analysis performed by NERL suggested a mean soil-to-dust transfer rate of 33 percent for lead. This was consistent with the transfer rates observed by NERL for other metals at the Site (arsenic = 31 percent, cadmium = 29 percent, and zinc = 32 percent). The 95th percent Upper Confidence Limit ("UCL") of the mean transfer rate for lead was calculated to be 41 percent. More technical information regarding the cited statistical analyses is presented in a report prepared by NERL for Region III (February 2001) and is included in the Administrative Record for OU #3.

Due to possible uncertainties in the soil and dust data sets, as well as in the regression analysis, Region III recalculated remediation goals for lead using the conservative estimate of the mean transfer rate, 41 percent. Applying the same exposure assumptions as in the BRA, the IEUBK Model indicated that with a soil-to-dust transfer rate of 41 percent, an average cleanup level of 950 mg/kg for lead in soil would be protective. The underlying premise associated with this remediation goal is that no other predominant sources of lead exposure exist. Consequently, the inherent protectiveness of using this cleanup level is contingent upon the abatement of lead-based paint, another common source of interior lead, at impacted residences.

Finally, Region III sought input from EPA's Technical Review Workgroup ("TRW") throughout the BRA process and during the recent recalculation of a soil remediation goal for lead at the Site. With regard to the latter, the TRW expressed concern related to estimating mass fraction based on soil and interior dust concentrations. [This issue is more thoroughly addressed by the TRW guidance document, *IEUBK Model Mass Fraction of Soil in Indoor Dust (Msd) Variable*, June 1998.] The TRW did not support the Site-specific soil-to-dust transfer rate of 41 percent, fearing that potential "noise" in the Palmerton analytical data may have artificially suppressed the predicted transfer coefficient. Instead, the TRW recommended using the IEUBK default value of 70 percent since this parameter was derived from several large, controlled studies. While Region III greatly appreciates and respects the recommendations of the TRW, the Region has confidence in the quality of the Palmerton (OU#3) soil and dust data sets, believes that use of the 95th percent UCL of the mean transfer rate provides a sufficient safety factor to account for uncertainties, and recognizes the benefit of lead-based paint abatement (which allows for a higher cleanup level for lead in soil). Therefore, upon consideration of the relevant factors, Region III has selected a soil remediation goal of 950 mg/kg for lead in soil, with contingencies, in this ROD.

B. Environmental Risk Evaluation

EPA is currently preparing a Site-Wide Ecological Risk Assessment for the Palmerton Zinc Superfund Site as part of OU #4. The principal purpose of the Ecological Risk Assessment is to determine the likelihood that biological species habitats in the Site area may be exposed to unacceptable risks from Site contaminants. The Ecological Risk Assessment will be incorporated into the OU #4 Remedial Investigation Report which is currently being prepared. Remedial alternatives to address any Site-wide ecological risks identified by the Ecological Risk Assessment will be considered as part of the OU #4 Feasibility Study. The community will have an opportunity to comment on the RI/FS and Ecological Risk Assessment during the remedy selection process of OU #4.

VII. SUMMARY OF REMEDIAL ACTION ALTERNATIVES

The Final FS Report discusses the alternatives considered for the cleanup of the contaminants of concern identified during the RI for the Site and provides supporting information leading to remedy selection by EPA. The FS initially proposes a multitude of alternatives. These alternatives are evaluated in a two step process; first, initial screening and then detailed analysis. The initial screening process evaluates all the alternatives for 1) effectiveness in protecting human health and the environment, 2) implementability, which is the alternatives' technical and administrative feasibility to be constructed, operated, and maintained, and 3) costs. A brief description of the alternatives and the detailed analysis of each follows below.

Following an initial screening, technologies and process options were combined into remedial alternatives representing a wide range of costs and effectiveness. Following further screening, four primary alternatives for residential soil and two alternatives for indoor dust remained. The alternatives were then evaluated and compared against each other in terms of protection of human health and the environment, compliance with Applicable or Relevant and Appropriate Requirements ("ARARs"), long-term effectiveness, reduction of contaminant toxicity, mobility or volume, short-term effectiveness, implementability, and cost. Present worth cost estimates for all of the alternatives are located in Table 4. The alternatives that were carried through to the detailed evaluation process are the following:

A. **Soil and Dust Alternative 1: No Action**. - The No Action alternative would not involve any remediation of residential soils or indoor dust. The No Action alternative is presented for comparison against other alternatives. The total estimated cost of this alternative is $0.

B. **Soil and Dust Alternative 2: Institutional Controls and Monitoring.** - The residences would be left in their current condition. Institutional controls, such as deed notices, local permitting, and public education would be implemented to prevent human exposure to contaminants above cleanup standards. Monitoring would be necessary to determine where institutional controls are necessary (where contaminants are found above cleanup levels) and to ensure that the institutional controls are effective in preventing exposure to the contaminants. The total estimated cost of this alternative is $733,000.

C. **Dust Alternative 3: Specialized Cleaning.** - This alternative involves cleaning up the indoor dust by HEPA vacuuming, wet wiping, and a second HEPA vacuuming. Soft and lead-based paint surfaces would only be HEPA vacuumed. Clearance testing on hard surfaces that are cleaned under this alternative would be performed after specialized cleaning using the same HUD protocols and procedures for lead-based paint abatement clearance sampling. There would also be educational material distributed for public education about the general dust hazard. The total estimated cost of this alternative is $1,436,000. The cost of this dust alternative is also included in the listed cost estimates for the active soil alternatives below.

D. **Dust Alternative 3A: Specialized Cleaning w/ Carpet Removal**. - This alternative is essentially the same as Alternative 3, above, except that if it is determined by EPA, in consultation with PADEP, that carpet removal and reimbursement is more effective at removing contaminants than HEPA vacuuming the carpets as well as being more cost effective, then carpet removal and reimbursement would be done. The total estimated cost of this dust alternative is $4,173,120.

E. **Soil Alternative 4: Removal/Re-vegetation**. - This alternative involves removal of all residential soil above 650 ppm lead. To generate cost estimates and evaluate this alternative, an average four-inch depth of excavation over 80 percent of the area of remediation, and an average six-inch depth of excavation over the remaining area was assumed. The soils would be excavated and replaced with clean soil. Plants and other vegetation would be replaced. Post-remediation sampling would be performed to confirm the achievement of remedial action objectives. The total cost of this alternative is estimated to be $26,349,000.

F. Soil Alternative 5A & 5B: Removal/Insitu Treatment/Re-vegetation. - Alternative 5 involves the removal of the surface soil and revegetation in 'hot spot'/targeted areas where pre-remediation eligibility sample results are significantly above the risk-based goal or where bare spots of soil exist. If necessary, this alternative includes insitu treatment of the remaining soil to meet remedial action objectives. Alternative 5 would remove soils that are significantly above cleanup standards and would amend or treat any soil that is left in place which causes the overall yard soil composite to be above 650 ppm. The soil would then be re-vegetated. Initially, approximately two inches of sod/soil vegetative cover in targeted hot spot areas would be excavated and disposed of. The insitu treatment of the soil below would be accomplished in one of two ways: A) either by thoroughly tilling in amended agricultural soil or added soil amendments, or B) by mixing chemical substances into the existing soil to make the metal contaminants insoluble. If there were significant soil removal, the top soil could be placed on top of the treated soil and, if necessary, the soil would be compacted. Re-vegetation could be accomplished by hydroseeding, mixing grass seed with the soil amendments, or in certain situations, sod might be utilized. Two weeks of watering would be provided to establish the vegetative cover. A public education effort associated with lead risks and lawn maintenance would be developed. Post-remediation sampling and vegetative cover observation would be performed to confirm the achievement of remedial action objectives.

Amended soil would be tilled into the existing soil under alternative 5A. This alternative would involve essentially the same procedures that were used in the EPA Interim Removal Action soil cleanups, including excavation of the top 2 inches of the most contaminated soils and tilling in soil amendments. The total estimated cost of this alternative is $11,121,000.

Alternative 5B would involve chemically treating insitu soils. Treatment could be with pozzolonic treatment or with another chemical treatment. Such a treatment process immobilizes the metals so that the soil passes the Toxicity Characteristic Leaching Procedure ("TCLP") criteria or the Universal Treatment Standards ("UTS") for non-hazardous waste. If this alternative was chosen, treatability studies would be conducted to determine the appropriate chemical mix/quantity for insitu treatment and to ensure that the treatment would adequately reduce contaminant mobility. The total cost of Alternative 5B is estimated to be $11,786,00.

G. **Soil Alternative 6: Soil Amendment and Re-vegetation.** This alternative is similar to the NHN Program already in existence. It is different from the NHN Program in that it would provide for pre- and post-remediation sampling and observation and a contractor would perform the remedial activities. Sampling and observation of the vegetative cover would show whether the remedial action goals were achieved. Having a contractor perform the work would decrease potential exposure for the residents during soil mixing and would reduce potential variability in the remediation result.

Agricultural-type soil amendments such as mushroom compost, limestone, fertilizer, and grass seed would be spread across a yard and thoroughly tilled into the soil where conditions do not meet remedial action objectives. This would reduce the concentration of contaminants and establish a healthy vegetative barrier to soils below. Re-vegetation could be accomplished by hydroseeding, spreading grass seed with the soil amendments, or in certain situations, sod might be utilized. Two weeks of watering would be provided to establish the vegetative cover. A public education and maintenance program would be developed to assist the homeowners in maintenance of the newly-grown vegetative cover. Post-remediation sampling and vegetative cover observation would be performed to confirm the achievement of remedial action objectives. The main difference between this alternative and Alternative 5A is that no soil would be removed. The total estimated cost of this alternative is $11,255,000.

The following Alternative was submitted to EPA on March 30, 2000, by Viacom International Inc. ("Viacom"). The text below is a brief description of the Alternative using verbatim excerpts from the Viacom submittal. The complete submittal along with followup information provided by Viacom on May 12, 2000, to clarify the Alternative can be found in the Administrative Record for OU#3.

H. **PRP Alternative 7: Public/Private Partnership.** This alternative combines several technologies already utilized in Palmerton through the EPA Interim Action, "Neighbor Helping Neighbor" ("NHN") Program and the Borough of Palmerton "Lead-Safe" Home Grant Program.

Exterior remediation would be accomplished by combining various activities including, but not limited to, in-situ soil treatment and/or focused soil removal and re-vegetation. The residential yard would initially be sampled and will only be eligible for remedial consideration if the arithmetic average or overall composite of the exterior soil samples from that property exceeds the 650 ppm lead action level. Selection of sampling strategy and specific remedial actions will be a function of the remedial design/remedial action process.

Prior to any exterior remediation, homes eligible for remedial consideration would undergo an analysis for indoor lead-based paint. This examination will be conducted only with the property owner's consent. The analysis shall be conducted utilizing the guidelines of the United States Department of Housing and Urban Development ("HUD"). Because lead-based paint abatement falls outside the scope of Superfund authority, the interior remedial action will be undertaken with the assistance of the Potentially Responsible Parties ("PRPs") at the Site as part of a Public/Private Partnership. If a home that is eligible for remedial consideration, based upon exterior soil analysis, also qualifies for indoor lead-based paint abatement, such abatement would be conducted consistent with the homeowner's agreement, subsequent to exterior remediation.

Following interior lead-based paint analysis, potential remedial activity at eligible properties would be conducted in the following manner. First, determination of the overall mix of remedial activity will be made based on home eligibility, homeowner consent, and factors in EPA's Palmerton Risk Assessment. In the event that a home qualifies for indoor lead-based paint abatement and the homeowner denies access, or in the event the indoor lead-based paint assessment demonstrates no need for such abatement, then the *exterior soil* remedial action lead level would be modified to 1050 ppm.

In the event that indoor lead-based paint abatement is not conducted on a home that qualifies for such, because the home owner did not consent to lead-based paint abatement, then the exterior soil remediation would be conducted based on a 650 ppm lead cleanup level. Regardless of the cleanup level, consideration also would be given to existing vegetative cover at each residential property. If an existing and satisfactory vegetative cover barrier is maintained indefinitely, there is little potential for lead to be mobilized through mechanisms such as wind and water erosion or soil tracking into households (and thereby into the indoor dust exposure pathway). In other words, the existing vegetative cover may already be sufficient to meet the remedial objectives.

With the remedial action fully defined and with appropriate homeowner consent, the exterior soil remedial action would then be implemented first, followed by the interior remedial action. Exterior remedial action would include a combination of actions detailed below. For in-situ treatment of soil, either pre-amended soil would be tilled into remaining soil or agricultural soil amendments such as mushroom compost, limestone, fertilizer, and/or clean topsoil would be tilled in. Since historical data indicates contaminants are concentrated at the surface, this mixing would reduce the concentration of contaminants. The appropriate depth of tilling would be based on soil chemical and physical characteristics and soil conditions determined from pre-design sampling. Additionally, the amendment formula may vary from residence to residence. If necessary, the soil would be compacted. Removal of soil would include off-site disposal of that soil in a manner meeting applicable regulations. Excavated soil would be replaced with clean soil or a mixture of soil and amendments meeting landscaping specifications. To the maximum practical extent the land would be returned to original grade. Proper dust suppression would be conducted during construction.

Remediated areas would be re-vegetated to create a barrier to the soils below. Based on site conditions, re-vegetation would be accomplished by hydroseeding, mixing grass seed with soil amendments, or by use of sod, as appropriate. Two weeks of watering would be provided to establish the vegetative cover. Public educational materials would be distributed to assist all homeowners in maintaining existing or newly-grown vegetative cover, and to explain the importance of maintaining the vegetative barrier.

Subsequent to exterior remedial action, if any, homes eligible for, and interested in, interior remedial activity as described above would be addressed. Abatement would be conducted to the extent agreed upon by the homeowner. Abatement activity would be conducted in accordance with the HUD protocols for abatement of lead-based paint. Public educational materials would be distributed to homeowners in the event lead-based paint is detected in a resident's home below action levels, or if a resident declines abatement activity when lead-based paint is detected above action levels.

Post-remediation sampling and vegetative cover observation at properties receiving remedial action would be performed to confirm the achievement of remedial objectives. Likewise, at the conclusion of abatement work, residences qualifying for interior remedial activity would have clearance testing performed in accordance with HUD guidelines. The present worth cost estimate for Alternative 7 is $13,656,000.

On May 12, 2000, additional clarifying information regarding PRP Alternative 7 was provided to EPA on behalf of Viacom. The additional information provided further discussion on the rationale for raising the exterior soil Site-specific standard to 1050 ppm, and to clarify that interior dust sampling would not be conducted as part of the lead-based paint abatement component of PRP Alternative 7. The information also clarified that home interiors that require lead-based paint abatement under PRP Alternative 7 would be HEPA-vacuumed after abatement and, should it be demonstrated that a home does not require lead-based paint abatement, that the home would also be HEPA-vacuumed.

VIII. SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

Each of the remedial alternatives described above was evaluated using nine criteria. The resulting strengths and weaknesses of the alternatives were then weighed to identify the alternative providing the best balance among the nine criteria. These nine criteria are:

Threshold Criteria

- Overall protection of human health and the environment: Whether the remedy provides adequate protection and how risks posed through each pathway are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

- Compliance with ARARs: Whether or not a remedy will meet all applicable or relevant and appropriate requirements of Federal and State environmental statutes and/or whether there are grounds for invoking a waiver and whether or not the remedy complies with advisories, criteria, and/or guidance that may be relevant.

Primary Balancing Criteria

- Long-term effectiveness and permanence: The ability of the remedy to afford long-term, effective, and permanent protection to human health and the environment, along with the degree of certainty that the alternative will prove successful.

- Reduction of toxicity, mobility, or volume: The extent to which the alternative will reduce the toxicity, mobility, or volume of the contaminants causing the Site risks.

- Short-term effectiveness: The time until protection is achieved and the short-term risk or impact to the community, on-Site workers, and the environment that may be posed during the construction and implementation of the alternative.

- Implementability: The technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement that remedy.

- Cost: Includes estimated capital, operation and maintenance, and net present worth costs. The present worth analysis is used to evaluate expenditures that occur over different time periods by discounting all future costs to a common base year, usually the current year. This analysis allows the cost of remedial action alternatives to be compared on the basis of a single figure representing the amount of money that, if invested in the basis year and disbursed as needed, would be sufficient to cover all costs associated with the remedial action over its planned life.

Modifying Criteria

- State Acceptance: Whether the Commonwealth concurs with, opposes, or has no comment on the Selected Remedy.

- Community Acceptance: Whether the public agrees with the Selected Remedy. This is assessed in detail in the ROD Responsiveness Summary (Appendix D of this ROD) which addresses public comments received on the Administrative Record and the Proposed Plan

A. Overall Protection of Human Health and the Environment

Soil Alternatives

Alternative 1 is the No Action Alternative. As proposed, it would have no effect on the Site; therefore, it does not achieve protection of human health and the environment. The Institutional Controls/ Monitoring Alternative 2, would provide a minimal degree of protection of human health and the environmental by monitoring to identify areas of concern and instituting controls to attempt to prevent exposure.

When implemented properly, Alternatives 4, 5, 6, and 7 all address to varying degrees the concern of reducing residential exposure to soil above the risk-based cleanup level and of reducing residential soil as a source for contaminated house dust. Post-remediation sampling and observation would show in each instance whether the remedial goals have been met. The long-term risks associated with residual contaminant concentrations are addressed to a greater degree by Alternatives 4 and 5 while Alternative 6 would reduce concentrations of contaminants by adding bulk amendments but would not remove any contaminants. Alternative 4 would remove all contaminated soil above the cleanup standards and therefore would provide the greatest long-term protectiveness. Alternative 5 would remove the most contaminated soils thereby providing greater long-term risk reduction. The short-term exposure of Alternative 4 could be less than Alternatives 5, 6, and 7 because it is possible that Alternative 4 would generate less dust from excavation activities than Alternatives 5, 6, and 7 would generate from the tilling and mixing activities. Alternatives 4, 5, 6, are 7 all are anticipated to require a similar duration of time to be completed.

With regard to exterior soils, PRP Alternative 7 is similar in protectiveness to Alternative 5 in instances where exterior soil cleanup is performed to the 650 ppm average soil cleanup level. However, in instances were exterior soil cleanup would be performed to the adjusted 1050 ppm cleanup level, protectiveness in the long term is diminished as the potential for future exposure to average soil and track-in dust above the 650 ppm average cleanup is still possible. Since receiving comments on the Proposed Plan and reevaluating the lead soil-to-dust track-in rate, EPA has determined that an exterior soil cleanup level of 950 ppm would be protective at residences where it can be positively proven that there is no additional risk posed by interior lead-based paint. In addition, PRP Alternative 7, as described by Viacom, would rely more heavily on existing vegetative cover for protectiveness making long-term lawn maintenance essential for protectiveness in the future. If the reliance on vegetative cover for protectiveness is eliminated from PRP Alternative 7 and tilling and hot spot excavation are implemented to reach cleanup standards, the long-term protectiveness of PRP Alternative 7 increases greatly.

Dust Alternatives

Alternative 1 is the No Action Alternative. As proposed, it would have no effect on the Site; therefore, it does not address any of the identified concerns. The Institutional Controls/ Monitoring Alternative 2 would provide a minimal degree of protection of human health and the environment by monitoring to identify residences of concern and providing education to attempt to prevent exposure.

Alternative 3 would remediate the indoor dust. Alternative 3 would not alter the toxicity or persistence of the contaminants. Permanence of the solution would result from removing the dust only after the outside residential soil source is remediated. The short-term exposure risk would be negligible if the remediation workers are properly trained and use the correct cleaning equipment and procedures. Alternative 3 is anticipated to require a few days per residence to be completed unless carpet removal and replacement is warranted after specialized cleaning efforts prove ineffective in meeting remedial action objectives.

PRP Alternative 7, while providing an evaluation for and potential abatement of lead-based paint present in a residence, does not, as described, provide for direct evaluation of lead dust tracked in from exterior soils. As discussed above, EPA has determined that the majority of lead contaminated dust in residences is a result of track-in of contaminated exterior soils. However, if HEPA vacuuming of living areas was implemented as described in the PRP Alternative 7 and HUD clearance levels for interior surfaces were attained, the tracked in dust would be addressed.

B. Compliance with ARARs

Soil Alternatives

Alternative 1, the No Action Alternative, and Alternative 2, Institutional Controls/ Monitoring, do not meet ARARs. Alternatives 4, 5, 6, and 7 would meet Federal and State of Pennsylvania ARARs and other regulations To Be Considered ("TBCs").

Dust Alternatives

The No Action Alternative and Institutional Controls/Monitoring Alternative do not meet ARARs. Alternative 3, 3A, and 7 would meet ARARs and TBCs.

C. Long-Term Effectiveness for Meeting Remedial Action Objectives and Permanence

Soil Alternatives

Long-term effectiveness and permanence of remedial alternatives is the greatest for Alternative 4 with its complete removal of soils above the 650 ppm cleanup level. Alternative 5 would also remove soils which are significantly above the cleanup level and thereby provide a greater degree of permanence and long-term protectiveness than Alternative 6. Alternatives 5, 6, and 7 rely to varying degrees on soil mixing/treatment, soil amendments, and establishment and maintenance of a vegetative barrier to reduce potential future exposure. If hot spots are removed, the soil/mixing/treatment via tilling would better achieve the objectives of reducing overall exposure in a yard to below performance standards. Alternative 5 would provide greater permanence and long-term effectiveness with regard to exterior soils than Alternative 7 because it includes a preference toward targeted/ "hot spot" soil removal. While Alternative 7 includes a component for soil removal, as described, it would include a greater reliance on owner maintenance of a vegetative cover to meet remedial action objectives. If Alternative 7 did not have this preference, it would provide essentially equivalent long-term effectiveness as Alternative 5.

Dust Alternatives

Alternatives 1 and 2 would not remediate dust above the cleanup level and therefore would not be effective in the long term. Alternatives 3 and 3A would effectively remediate the contaminated track-in house dust. Based on effective source control of the residential yard source and public education on additional possible lead risks associated with lead-based paint, this alternative would be effective for the long term. However, neither Alternative 3 or 3A would address lead-based paint hazards directly because lead-based paint is outside the authority of Superfund. Alternative 7, while providing an evaluation for and potential abatement of lead-based paint present in a residence, does not, as described, provide for direct evaluation through sampling of lead dust tracked in from exterior soils. As discussed above, EPA has determined that the majority of lead contaminated dust in residences is a result of track-in of contaminated exterior soils. However, if HEPA vacuuming of living areas was implemented as described in Alternative 7, and HUD clearance levels for interior surfaces were attained, the tracked in dust would be addressed and any potential lead source from lead-based paint would also be addressed.

D. Reduction of Toxicity, Mobility, and Volume

Soil Alternatives

The No Action Alternative and Institutional Controls/Monitoring Alternative would not have any effect on these criteria. With Alternative 4, all soil above the cleanup level would be removed and replaced with clean fill. Alternatives 5 , 6, and 7 incorporate insitu treatment as part of the remedial action, including tilling in soil amendments (5A, 6, and 7) or chemical additives (5B) and mixing with the underlying soils.

Alternatives 5, 6, and 7, to varying degrees, use a vegetative barrier to help isolate the treated soils from direct human exposure and from erosion/mobilization by wind and rain. Therefore, contaminant mobility would be reduced by all of the action alternatives. Alternatives 4, 5, and 7 would also reduce the mobility and volume of the contaminants by removing and disposing of excavated soil in a landfill. The chemical treatment with Alternative 5B is proven to reduce contaminant mobility due to leaching. None of the alternatives proposes to change the toxicity or persistence of the contaminants.

Soil treated in situ under Alternatives 5, 6, and 7 would have a volume or "bulking" increase from the incorporation of additives to the soil. Depending upon the chemical process used, a volume increase of 5 to 20 percent is anticipated for Alternative 5B. The amount of volume increase from tilling under Alternatives 5A, 6, and 7 is unknown but may be significant, possibly greater than 20 percent. Bulking would occur as a result of both adding mass to the soil from the amendments and from reducing the soil density during mixing of the amendments into the soil. Recompaction of insitu treated soil could reduce much of the change in volume from

bulking. Excavated soil volumes would also increase from bulking due to the excavation and disturbance. The bulking of excavated soil is estimated to be approximately 10 percent.

Dust Alternatives

Alternatives 1 and 2 would not remediate the dust which is above the cleanup level. Alternatives 3 and 3A would not reduce the toxicity, volume, or persistence of contaminants in the dust, but would reduce the volume of dust in living areas. The mobility of the contaminants would be reduced since the waste generated during cleanup would be properly disposed in a landfill. PRP Alternative 7 would reduce the mobility of lead in lead-based paint found in residences through abatement, and, as stated above, includes HEPA vacuuming of homes after lead-based paint evaluation or abatement and would also reduce the volume of lead dust in a home.

E. Short-Term Effectiveness

Soil Alternatives

Most of the active remedial actions are similar in the technologies proposed for implementation. Exposure to fugitive dust generated by the remedial activities is the common short-term risk. Localized releases of potentially contaminated dust during remediation would be minimized by standard dust control techniques. Protection would be enhanced by dust monitoring during construction activities. For all of the action alternatives, construction contractors would need protection against dermal and respiratory exposure to the dust while working in contaminated areas, if sampling proves it is necessary. Protective clothing and respirators or dust masks would help control this risk.

If appropriate dust control measures are implemented properly, all of the action alternatives would have similar short-term effectiveness. With respect to time of implementation, all alternatives are estimated to be roughly comparable. None of the action alternatives are expected to substantially adversely affect the communities during remediation. Each alternative could also include prioritizing residential yards of sensitive sub-populations in order to remediate the highest risks early in the remedial action and enhance short-term effectiveness.

Dust Alternatives

Alternatives 1 and 2 would not remediate the dust and therefore would not be effective.

Alternatives 3 and 3A would achieve short-term effectiveness. However, it is expected that some short-term inconvenience would be necessary during cleanup of home interiors. Temporary relocation of residents during remediation would minimize the short-term impact to residents. Similarly, Alternative 7 provides for evaluation and potential abatement of lead-based

paint present in a residence that may cause short-term inconvenience to residents. This inconvenience could be overcome by temporary relocation, if necessary.

F. Implementability

Soil Alternatives

The activities proposed as part of the action alternatives are well-developed, non-complex technologies. There are no great differences between the methods involved in completing the proposed remedial activities. The action alternatives involve removal of various depths of soil and vegetative cover and/or insitu treatment of soil, then placement and maintenance of replacement soil and re-vegetation. All of the activities are technically feasible and none require complicated technical expertise. All have similar levels of effort.

All of the action alternatives would require pre-design sampling to establish whether remediation is necessary and to determine the extent of remediation. Additional sampling to confirm the effectiveness of the remedy would have to be performed in all of the action alternatives. Public education would be important for all action alternatives.

None of the soil action alternatives are difficult in terms of constructibility. Both Alternatives 5 and 6 incorporate a healthy lawn as a barrier to the underlying treated soil. Vegetative maintenance/erosion prevention is important for both of these alternatives. However, Alternative 6 is the most sensitive to vegetative maintenance/erosion prevention requirements because it removes no existing soil and the vegetative cover is the only physical barrier between residents and the underlying amended soil.

Post-remediation sampling and observation would show whether the remedial objectives have been accomplished for all of the action alternatives. However, because no future maintenance would be necessary for Alternatives 4 and 5, they would be the most reliable. Long-term success and maintenance of the vegetative barrier is critical to the effectiveness of both Alternatives 6 and 7 since there would be a preference of relying upon existing vegetative cover to meet remedial action objectives. If PRP Alternative 7 did not have this preference, it would provide essentially equivalent overall implementability as Alternative 5 because the need to maintain the cover would not be essential for protectiveness.

Alternative 1 is a no action alternative and is not considered for this criteria. Ongoing environmental monitoring and institutional controls in Alternative 2 would be the most extensive and complicated.

Dust Alternatives

Alternative 1 is a no action alternative and is not considered for this criteria. Alternatives 3, 3A, and 7 would follow well-established protocols and would be easily implemented.

G. Cost

Soil and Dust Alternatives

For cost comparison purposes, the soil and dust alternatives are combined. Alternative 1 is a No Action alternative for both the soil and the dust. The remaining EPA action alternatives combine the active soil alternative with Dust Alternative 3.

Prior to any of the active remediation activities, a pre-design sampling program must be conducted at each residence to determine whether and to what extent remediation is necessary (described in Sequence of Sampling Section, below). This cost will remain the same irrespective of which alternative is chosen. The pre-design sampling costs are not included in any of the alternative cost estimates. Section 7.1 of the FS discusses and lists the possible pre-design per sample costs.

The cost comparisons between alternatives are straightforward. Comparing present worth costs, Alternative 4 is the most expensive followed by Alternative 7. The other action alternatives are all similar in cost. Alternative 1: No Action, has no direct cost associated with it. Alternative 1 is used as a baseline to compare the other alternatives. Alternative 2, the Institutional Controls/Monitoring alternative, is the least expensive action alternative but it would have ongoing monitoring costs that could extend past the period assumed by the present worth analysis (see below) and would not be protective.

The FS cost estimates shown have been prepared for guidance in project evaluation and implementation from the information available at the time of the estimate. The areal extent, depth, and concentration of soil contamination greatly influences the cost estimates and would be determined at each residence from pre-design sampling. Detailed cost evaluations and the assumptions used are presented in Appendices A and B of the Feasibility Study and in the PRP-submitted information for Alternative 7. A summary of the costs for the alternatives is shown in Table 3. A cost sensitivity analysis and discussion is presented in Section 6.4 of the Feasibility Study and is also included in the PRP-submitted information for Alternative 7 to illustrate the effects that changes in specific assumptions might have on the costs.

Capital costs are those required to initiate and construct the remedial action. Typical capital costs include construction equipment, labor and materials expenditures, engineering services, health and safety, and construction management costs. Operations and maintenance ("O&M") costs are ongoing expenses necessary to ensure the continued effectiveness of a remedial action. Included in O&M costs for this alternative are such items as implementation of institutional controls, community awareness initiatives, and administrative costs. A 15 percent contingency is added to both the total capital and total operations and maintenance costs.

Present worth analysis is a method of evaluation of expenditures that occur during different time periods. By discounting all alternative costs to a common year (Year 0), the true costs for different alternatives can be compared. The present worth represents the amount of money in today's dollars needed to cover all the expenditures associated with an alternative. The cost estimates use a four percent discount rate for a period of up to 30 years. This implies that inflation outpaces O&M costs by four percent per year. Five years of O&M costs are included for the alternatives. The analysis does not evaluate any ongoing O&M costs for periods past 30 years for any of the alternatives.

Corrections to the Final Feasibility Study Alternative Costs

The total present worth cost for Alternative 5A in the May 2000 Final Feasibility Study and also in the June 2000 Proposed Remedial Action Plan were incorrectly listed as $11,121,000. These costs were incorrectly calculated based on exterior soil cleanup and interior dust cleaning costs associated with Alternative 3 for 778 properties in the Palmerton Borough and 778 properties for interior cleanup outside the Borough. The estimate of properties potentially eligible for interior cleanup under Alternative 3 outside the Borough is actually 252 as was correctly reflected in the discussion in Appendix A of the FS. Following issuance of the Proposed Plan, EPA determined that the total costs were incorrectly calculated due to this error. The correct present worth costs based on exterior soil cleanup under Alternative 5A and interior dust cleaning costs associated with Alternative 3 for 778 properties in the Palmerton Borough and 252 properties outside the Borough is $10,710,00. A revised summary cost table is provided as Table 3 which reflects this correction for each alternative.

In addition, the total present worth costs for the preferred alternative in the June 2000 Proposed Plan was listed as $11,121,000 and was based on the exterior soil cleanup and interior dust cleanup of a total of 1030 properties utilizing Alternatives 5A/3. In order to be conservative regarding potential cost estimates, the total present worth costs should have also included the costs of interior dust Alternative 3A. The costs of Alternative 3A were calculated assuming that no more than 2/3 of homes eligible for interior cleanup under Alternative 3 would require carpet removal and replacement. The total present worth for Alternative 3A is $4,173,120. Therefore, the conservative estimate of present worth costs for the preferred alternative should have been:

Revised FS costs for Alternatives 5A/3, assuming 778 residences in Palmerton and 252 residences outside the Borough – $10,710,000
Costs for carpet replacement and cleaning of 690 residences - $ 4,173,120
Total Present Value Costs- $14,883,120

This total is a conservative estimate because it is not expected that every eligible interior would receive both the specialized cleaning described in Alternative 3 and the carpet replacement and cleaning described in Alternative 3A.

H. State Acceptance

PADEP has assisted EPA in the review of reports and Site evaluations for Operable Unit #3, Community Soils, Palmerton Zinc Superfund Site. PADEP agrees with the Selected Remedy and the Contingent Remedy and has concurred on this Record of Decision.

I. Community Acceptance

Pursuant to CERCLA § 113(k)(2)(B)(I)-(v), EPA released for public comment the final RI/FS reports and the Proposed Remedial Action Plan setting forth EPA's preferred alternative for Operable Unit #3, Community Soils, Palmerton Zinc Superfund Site on June 5, 2000. EPA also made these documents available to the public in the Administrative Record located in the EPA Administrative Record Room in Region III's Philadelphia office and at the Palmerton Public Library, Palmerton, Pennsylvania. The notice of availability of these documents was published in the <u>*Lehighton Times News*</u> and the <u>*Allentown Morning Call*</u> on June 5, 2000.

A public comment period on the documents was held from June 5, 2000, to September 2, 2000. In June 2000, EPA issued a Fact Sheet announcing the availability of the Proposed Remedial Action Plan and a public meeting. The June 2000 Fact Sheet discussed EPA's Preferred Alternative, as well as other alternatives evaluated by EPA, and solicited comments from all interested parties. In addition, EPA conducted a public meeting on June 28, 2000. At this meeting, representatives from EPA answered questions and attempted to address concerns about OU#3 and the remedial alternatives under consideration. The responses to all comments received during the public comment period are included in the Responsiveness Summary, which is Appendix D of this ROD.

IX. THE SELECTED REMEDY & CONTINGENT REMEDY: DESCRIPTION AND PERFORMANCE STANDARD(S) FOR EACH COMPONENT OF THE SELECTED REMEDY & CONTINGENT REMEDY

A. General Description of the Selected Remedy and Contingent Remedy

EPA carefully considered state and community acceptance of both the Selected Remedy and Contingent Remedy prior to reaching the final decision regarding the remedy for OU#3. The Agency's Selected Remedy and Contingent Remedy are set forth below.

Based on current information, if consensual agreement on remedial design and remedial action can be reached between EPA and the PRPs in a reasonable time frame, a slightly modified Alternative 7 is protective of human health and the environment and provides the best balance among the alternatives with respect to the nine criteria EPA uses to evaluate each alternative.

However, if the modified Alternative 7 is not used, the Contingent Remedy, as set forth below, is also protective of human health and the environment and would provide the best balance among the alternatives which EPA could implement under CERCLA with respect to the nine criteria EPA uses to evaluate each alternative. Both the Selected Remedy and the Contingent Remedy, as described in this ROD, will address the lead and arsenic contaminated exterior soil source and will address the tracked in exterior soil in interior dust. The Selected Remedy, modified Alternative 7, will also include evaluation and, if necessary, abatement of lead-based paint. However, the use of the Selected Remedy is contingent upon EPA and the PRPs reaching a consensual agreement whereby the PRPs agree to implement the remedy. If such an agreement can not be reached, the Contingent Remedy will address the industrial sources of lead contamination and leave the properties within the OU #3 area on a level playing field with all other homes in the United States constructed prior to 1978 with regard to lead-based paint.

1. Selected Remedy - Modified Alternative 7

The Selected Remedy, modified Alternative 7, incorporates residential exterior soil, interior lead-based paint, and specialized cleaning remedial actions for all homes that qualify for such remediation and in which the homeowners consent to participate. Because lead-based paint abatement falls outside the scope of Superfund authority, the interior remedial action, as described in modified Alternative 7, will be undertaken by the PRPs if a consensual agreement between EPA and the PRPs for remedial design and remedial action can be reached. The modifications to PRP Alternative 7 include the elimination of reliance on existing vegetative cover for protectiveness and provides for an exterior soil cleanup standard of 950 ppm. A discussion of how EPA arrived at the 950 ppm exterior soil cleanup standard can be found on pages 26-27 above, as well as in Section XI, below. This remedy is contingent upon any potential source of interior lead dust contamination from lead-based paint being identified and, if present, addressed appropriately unless the lead-based paint is determined not to pose a risk as determined by a licensed lead-based paint risk assessor.

a. Eligibility for Remedial Action

The following describes procedures to be followed to determine eligibility of a property for remediation under the Selected Remedy. Residences within the OU#3 area found to contain exterior soil with lead levels at or above 650 ppm will be eligible for remediation, the extent of which will be based upon residence-specific conditions determined through sampling. Residential property eligible for sampling includes single and multi-family dwellings, apartment complexes, vacant lots in residential areas, schools, daycare centers and playgrounds, parks, and green ways. EPA carefully considered comments received during the public comment period regarding "large undeveloped properties" and has decided that, on a case-by-case basis EPA, in consultation with PADEP, will determine if large undeveloped properties zoned residential in close proximity to existing homes will be eligible for cleanup. The determination will be based upon the undeveloped property's proximity to existing residential properties, the potential for re-contamination to occur on adjacent residential properties, the existence (or lack thereof) of pre-existing infrastructure for the large undeveloped lot, and any other factors which EPA determines would affect the protection of human health and the environment. Any necessary remediation will be the responsibility of the developer of those large undeveloped properties zoned residential but determined not eligible for remediation at such time in the future that the property is developed. Any such remediation would have to be completed in compliance with all applicable federal and state laws and regulations in effect at that time.

Property owners within the OU #3 area will be solicited to participate in sampling to determine eligibility for remedial action. Regardless of whether EPA or a PRP is conducting the remedial action, EPA personnel will participate significantly in the solicitation process. Appeals for participation will be made through local media outlets, fact sheets, and letters, as well as personal door to door visits, whenever possible. EPA will solicit participation for a limited time, the duration of which will be determined by EPA, in consultation with PADEP. After this solicitation period ends, responsibility for any future remedial actions taken to address lead contamination at a residence will be the individual property owner's responsibility.

b. Sequence of Sampling

Sampling for eligibility will be conducted in the following general manner. If a property owner requests sampling of his/her property, initially, under both the Selected Remedy and the Contingent Remedy, exterior sampling will be performed. A composite sample will be collected from each property. The number of sampling points and the locations which make up the composite sample will be determined by EPA, in consultation with PADEP; but at a minimum, the composite will be a representative sample from the front and back yard and, if appropriate, side yards and will exclude drip lines. Children's play areas will be sampled utilizing a separate composite sample from the play area. Play areas for individual residences will be defined during the remedial design process and the number of sampling points and their locations in the play area will be determined by EPA, in consultation with PADEP. Eligibility for the cleanup of play areas only will be based on a composite sample taken from the play area containing lead greater than 400 ppm, the level established by EPA in Subpart D of 40 CFR Part 745. Sampling will begin on exterior soils and play areas because EPA's risk-based standard is based on exterior soils being the primary source of industrial interior dust contamination and play areas pose the most direct exposure risk to the most sensitive population.

Residences found to contain exterior soil with lead levels, as determined by the composite sampling, at or above 650 ppm lead, will be eligible for remediation, the extent of which will be based on residence specific conditions determined through the sampling. There will be no age of resident or income eligibility requirements. Sampling results will be provided to each resident. If eligibility sampling determines that a property is eligible for remedial action and the property owner(s) chooses not to participate in the remedial action, some type of institutional control administered cooperatively by the State and local government will need to be implemented to ensure that future buyers of the property are aware of the sampling results.

Under the Selected Remedy, modified Alternative 7, those who are eligible for remedial action will then be offered the opportunity to have their home evaluated by a licensed lead-based paint risk assessor, consistent with Subpart D of 40 CFR Part 745, for lead-based paint risks. The analysis shall be conducted only with the homeowner's consent. If the homeowner agrees, the home will be inspected and risks (if any) due to lead-based paint will be identified by the risk assessor for the homeowner. If abatement work is necessary and agreed to by the homeowner, it will be conducted subsequent to exterior remediation consistent with Subpart D of 40 CFR Part 745.

In addition, home interiors that require lead-based paint abatement will be HEPA vacuumed after the abatement. Should it be demonstrated that a home does not require lead-based paint abatement, that home will also be HEPA vacuumed. In either situation described above, clearance testing will be performed in accordance with Subpart D of 40 CFR Part 745 following HEPA vacuuming. Following the abatement work, the home will be HEPA vacuumed throughout the living space and then wipe samples will be collected and compared to current clearance levels for sills, trough, and floors found in Subpart D of 40 CFR Part 745. With the remedial action fully defined and with appropriate homeowner consent, the exterior soil remedial action will be implemented first, followed by the interior remedial action.

In the event that indoor lead-based paint evaluation and/or abatement is not conducted on a home that qualifies because the home owner did not consent to lead-based paint evaluation and abatement, the exterior soil remediation will be conducted until a 650 ppm lead cleanup standard is achieved.

c. Extent of Soil Remediation

For each residential yard, the exact nature of the remediation would have to be considered on a property-by-property basis and would be based upon the results of samples obtained from the property, as well as the property's unique conditions. In general, the following areas could be eligible to be remediated in each residential yard:

- Sod/lawn areas
- Alleys (if unpaved) to the extension of the lot lines
- Planters, beds, and other landscaped areas
- Garden areas
- Unpaved driveways
- Garages with dirt floors

In short, remediation would occur in any area within and adjacent to the residential yard where residents could potentially come in contact with soils above the cleanup levels.

The exterior remedial action will include a combination of actions. For in-situ treatment of soil, either pre-amended soil will be tilled into remaining soil or agricultural soil amendments, such as mushroom compost, limestone, fertilizer, and/or clean topsoil, will be tilled in. Since historical data indicates contaminants are concentrated at the surface, this mixing will reduce the concentration of contaminants. The appropriate depth of tilling will be based on soil chemical and physical characteristics and soil conditions determined from pre-design sampling. Additionally, the amendment formula may vary from residence to residence. If necessary, the soil will be compacted. Removal of soil will include off-site disposal of that soil in a manner meeting applicable regulations. Although the depth of removal is anticipated to be shallow, underground utilities may have to be marked or cleared prior to excavation and excavation near utilities will have to be undertaken according to established regulations and safety procedures. Excavated soil will be replaced with clean soil or a mixture of soil and amendments meeting landscaping specifications. To the maximum extent practicable, the land will be returned to original grade. Proper dust suppression will be conducted during construction. To the maximum extent practicable, yard landscaping will be returned to its original condition. Appropriate air monitoring will be conducted to identify the possible occurrence of contaminant migration during remedial activities. Any exceedance of the standards would result in immediate implementation of additional dust suppression measures or a shutdown of construction activities.

Remediated areas would be re-vegetated. Based on Site conditions, re-vegetation would be accomplished by hydroseeding, mixing grass seed with soil amendments, or by use of sod, as appropriate. Two weeks of watering would be provided to establish the vegetative cover. Public educational materials would be distributed to assist all homeowners in maintaining existing or newly-grown vegetative cover.

Subsequent to exterior remedial action, if any, homes eligible for, and interested in, interior remedial activity will be addressed. Abatement will be conducted to the extent agreed upon by the homeowner. Abatement activity will be conducted in accordance with the Subpart D of 40 CFR Part 745 for abatement of lead-based paint. Public educational materials will be distributed to homeowners in the event lead-based paint is detected in a resident's home below action levels, or if a resident declines abatement activity when lead-based paint is detected above action levels.

Under the Selected Remedy, modified Alternative 7, an average risk-based goal of 950 ppm lead in soil, as determined through composite sampling, would be applied in exterior soils only if any potential source of interior lead dust contamination from lead-based paint is identified and addressed appropriately, or lead-based paint is determined not to pose a risk as determined by a state-licensed risk assessor. If the potential source of interior lead dust contamination from lead-based paint can not be identified (i.e., a resident does not consent to the evaluation), or if present but not addressed appropriately, then the average risk-based goal of 650 ppm lead in soil would be applied on a residence-by-residence basis. All of the alternatives are designed such that implementing the lead-based remedy would also meet the arsenic goals identified in the BRA. However, in the cleanup scenario where the 950 ppm exterior soil lead

cleanup standard is appropriate, analysis for arsenic will be required as part of clearance sampling to ensure that average arsenic soil levels are below 79 ppm.

Post-remediation composite sampling will be performed to confirm the achievement of remedial action objectives for exterior soils. Likewise, at the conclusion of abatement work, residences qualifying for interior remedial activity will have clearance testing performed in accordance with Subpart D of 40 CFR Part 745. See Figure 2 for flow chart of Selected Remedy.

d. Performance Standards

Each component of the Selected Remedy - modified Alternative 7 - and its Performance Standards are described below.

1. Participation/Solicitation

a. General notification of the solicitation period of the remedial action shall be accomplished through general distribution of fact sheets and via notices in local media outlets.

b. Every property owner in the Operable Unit #3 area (as defined in this ROD in Section IV, above) shall be contacted to determine their interest in participating in eligibility sampling. Property owner contact shall be verified. The type of verification shall be determined by EPA, in consultation with PADEP, during the remedial design.

c. Properties where exterior soils were previously addressed under the EPA Interim Removal Action shall not be eligible for sampling.

d. Participation solicitation will be conducted for a limited time, the duration of which will be determined by EPA, in consultation with PADEP. After this solicitation period ends, responsibility for any future remedial actions taken to address lead contamination at a residence will be the individual property owner's responsibility.

2. Eligibility Sampling

a. A composite sample will be collected from each property.

b. The number of sampling points and the locations which make up the composite sample will be determined by EPA, in consultation with PADEP, but at a minimum the composite will be a representative sample from the front and back yard and, if appropriate, side yards, and will exclude drip lines.

c. The analytical method(s) will be determined during the remedial design process but shall, at a minimum, be an EPA-approved method. The analytical method(s) will be reviewed and approved by EPA, in consultation with PADEP.
d. Residences found to contain exterior soil with lead levels, as determined by the composite sampling, at or above the Site-specific risk-based trigger of 650 ppm will be eligible for remediation, the extent of which will be based on residence

specific conditions determined through the sampling and remedial process.

e. There will be no age of resident or income eligibility requirements for composite sampling eligibility.

f. Sampling results shall be provided to each property owner where sampling is conducted and confirmation that this information has been provided to the property owner must be provided, consistent with Subpart D of 40 CFR Part 745.

g. If eligibility sampling finds that a property is eligible for remedial action and the property owner(s) chooses not to participate in the remedial action, some type of institutional control administered cooperatively by the State and local government will need to be implemented to ensure that future buyers of the property have notice of the sampling results for that property.

h. The exact nature of the institutional control will be determined during the remedial design process.

3. Residential play areas

a. Children's play areas will be sampled utilizing a separate composite sample from that of the residential yard. Play areas for individual residences will be defined during the remedial design process and the number of sampling points and their locations in the play area will be reviewed and approved by EPA, in consultation with PADEP, during the remedial design process.

b. Eligibility for the cleanup of play areas only will be based on lead levels greater than 400 ppm.

c. Eligibility for cleanup of play areas shall be independent of eligibility for cleanup of the entire yard.

d. Cleanup of play areas shall be accomplished utilizing the cleanup methods and standards described below in subsection 7 (Exterior Soil Remediation) until a

composite clearance sample from the play area confirms that concentrations are below 400 ppm lead.

4. Lead-based paint assessment

a. Owners of properties found to be eligible for remedial action under subsections 2. and/or 3. above, will then be offered the opportunity to have their home evaluated by a licensed lead-based paint risk assessor for lead-based paint risks consistent with Subpart D of 40 CFR Part 745.

b. The lead-based paint evaluation shall be conducted only with the homeowner's consent. If the homeowner agrees, the home will be inspected by a licensed risk assessor, who will identify risks (if any) due to lead-based paint consistent with Subpart D of 40 CFR Part 745.

c. The results of the lead-based paint inspection shall be provided to and discussed with the homeowner and confirmation that this information has been provided to the homeowner must be provided, consistent with Subpart D of 40 CFR Part 745.

d. If the risk assessor determines that abatement work is necessary and the homeowner agrees to the abatement work, it shall be conducted subsequent to exterior remediation in accordance with appropriate HUD guidelines and state regulations consistent with Subpart D of 40 CFR Part 745.

e. Short-term temporary relocation of residents may be necessary during the abatement work. The exact arrangements for relocation shall be determined on a case-by-case basis during the remedial design. EPA, in consultation with PADEP, will review and approve temporary relocation plans for residents during the remedial design process.

5. Specialized HEPA cleaning

a. Residences where lead-based paint abatement is conducted shall be HEPA vacuumed following completion of the abatement work. HEPA vacuuming shall be conducted in all living areas and shall include floors and upholstered furniture.

b. Should it be demonstrated that a home does not require lead-based paint abatement, all living areas of that home will still be HEPA vacuumed.

6. Clearance testing

a. Following HEPA vacuuming, clearance testing will be performed in accordance with Subpart D of 40 CFR Part 745. Wipe samples shall be collected and compared to current clearance levels for sills, trough, and floors.

b. The results of the clearance sampling shall be provided to the homeowner and confirmation that this information has been provided to the homeowner must be provided, consistent with Subpart D of 40 CFR Part 745. Once analysis of the interior clearance samples shows that clearance criteria have been met, the interior cleanup of the property is complete. Should clearance samples not meet clearance criteria, additional interior cleanup measures shall be implemented until clearance standards are attained.

7. Exterior Soil Remediation.

a. If the potential source of interior lead dust contamination from lead-based paint can not be identified (i.e., a resident does not consent to the evaluation), or if present is not addressed appropriately consistent with Subpart D of 40 CFR Part 745. (i.e., the homeowner does not consent to the abatement work), then an average risk-based goal of 650 ppm lead in soil, as determined through composite sampling, will be employed at that residence.

b. An average risk-based goal of 950 ppm lead in soil, as determined through composite sampling, shall be applied for exterior soils only if any potential source of interior lead dust contamination from lead-based paint is identified and, if present, addressed appropriately, or lead-based paint is determined not to pose a risk, as determined by a licensed risk assessor. Residences found to contain exterior soil with lead levels, as determined by the composite sampling, at or above the Site-specific risk-based trigger of 950 ppm will be eligible for remediation, the extent of which will be based on residence-specific conditions determined through the sampling and remedial process.

c. Remediation of qualifying residential properties shall be accomplished by tilling in either pre-amended soil or agricultural-type amendments, as necessary, and/or excavation, removal, and proper disposal of targeted soils.

1) Areas requiring tilling and/or targeted excavation and removal shall be determined through either analysis of individual aliquots of the eligibility sampling and/or other sampling methods, as appropriate.

2) The analytical method(s) will be determined during the remedial design process but shall, at a minimum, be EPA-approved method(s). The analytical method(s) must be reviewed and approved by EPA, in consultation with PADEP.

3) Collection and analysis of additional samples may be necessary to determine the most effective area to be tilled or excavated in order to meet the appropriate cleanup goals.

d. Tilling in soil amendments and/or excavation shall continue until a concentration in a post-remediation composite clearance sample below the appropriate cleanup standards is achieved.

e. Proper disposal of excavated soil or dust from Site remediation activities shall be determined by whether or not it passes the TCLP for lead, cadmium, and arsenic. If excavated materials pass the TCLP, they may be disposed of in a non-hazardous waste landfill. If excavated materials do not pass the TCLP, they must be disposed of at a Subtitle C hazardous waste landfill.

1) If the excavated soils are determined to be hazardous wastes the Federal Hazardous Waste Regulations incorporated by PADEP would be applicable for the identification, generation, and handling of hazardous wastes. The applicable portions of these regulations include: 40 CFR 262.11 (hazardous waste determination); 25 PA Code Chapter 262a, subchapter B and incorporated portions of 40 CFR Part 262, Subpart B (manifest); and 40 CFR part 262, Subpart C (pre-tranport requirements); 40 CFR 264.114 subpart G (disposal or decontamination of equipment and structures); 40 CFR 264.171-179 (temporary use and management of containerized waste); 40 CFR 264.251-258 (temporary storage of containerized waste); and 40 CFR 264.192-194, 197-199 (tank storage).

2) If the excavated soil passes the TCLP then the transfer, storage, and disposal of the waste material must comply with the PADEP Residual Waste Management Regulations which include the following: 25 PA Code Chapter 287 (general provisions for residual waste); 25 PA Code Chapter 299, subchapter A (standards for storage of residual waste) and subchapter B (standards for collecting and transporting of residual waste).

f. Dust control measures shall be implemented during construction in order to comply with fugitive dust regulations in the federally-approved State Implementation Plan for the Commonwealth of Pennsylvania, 25 PA Code §§ 123.1 - 123.2. and the National Ambient Air Quality Standards for Particulate Matter in 40 C.F.R. § 50.6 and PA Code §§ 131.2 and 131.3.

g. Sediment and erosion controls and temporary covers will be installed to protect exposed soil from the effects of weather consistent with PADEP's Bureau of Soil and Water Conservation Erosion and Sediment Pollution Control Manual and in accordance with 25 PA Code Chapter 102 (requirements for soil erosion and sedimentation control resulting from earth moving activities). Erosion potential shall be minimized. Further, controls in the form of Site grading to improve land grades, cover soils, vegetation, and drainage channels to reduce erosion potential from surface runoff may be required to minimize erosion. Contaminated soils shall be prevented from being washed into on-Site surface water and adjacent uncontaminated and uncontrolled wetland areas during remedial action implementation. The extent of erosion control necessary will be determined by EPA, in consultation with the PADEP, during the remedial design phase.

h. Appropriate air monitoring shall be conducted to identify the possible occurrence of contaminant migration during remedial activities.

1) The analytical method(s) will be identified during the remedial design

process but shall, at a minimum, be an EPA-approved method(s). The analytical method(s) must be reviewed and approved by EPA, in consultation with PADEP.

2) Any exceedance of the applicable standards shall result in immediate implementation of appropriate corrective measures until such standards are achieved.

i. Post-remediation composite sampling shall be performed to confirm the achievement of the appropriate cleanup standards for exterior soils.

1) The number of sampling points and the locations which make up the composite sample will be determined by EPA, in consultation with PADEP, but, at a minimum, the composite will be a representative sample from the front and back yard and, if appropriate, side yards and will exclude drip lines.

2) The analytical method(s) will be determined during the remedial design process but shall, at a minimum, be an EPA-approved method(s). The analytical method(s) will be reviewed and approved by EPA, in consultation with PADEP.

3) The results of the composite clearance sampling shall be provided to the homeowner and confirmation that this information has been provided to the homeowner must be provided, consistent with Subpart D of 40 CFR Part 745. Should analysis of the composite clearance samples show that the appropriate cleanup standard has been met, the soil cleanup of the property is complete. Should composite clearance samples not meet the appropriate cleanup standards, additional cleanup measures shall be implemented consistent with subsection 7. a.- h., above, until clearance standards are attained and verified via composite sampling.

j. Areas where soil is excavated shall be brought back to original grade using clean top soil whenever possible.

k. Reestablishment of vegetation shall be completed on all areas disturbed during soil remediation.

1) Re-vegetation of disturbed areas shall be accomplished by hydroseeding, mixing grass seed with soil amendments, or by use of sod, as appropriate.

2) Two weeks of watering shall be provided to establish the vegetative cover.

3) Public educational materials will be distributed to assist homeowners in maintaining newly-grown vegetative cover.

e. Selected Remedy Costs

The present worth cost estimate for Alternative 7, as provided by Viacom for the FS, is \$13,656,000. However, based on the modifications to the Alternative as described above, the costs may increase slightly if a larger number of homes qualify for exterior remediation. The exact amount of the increase in cost cannot be predicted until eligibility sampling activities are well underway.

In summary, based on current information, if consensual agreement on implementation of remedial design and remedial action can be reached between EPA and the PRPs in a reasonable time-frame, a slightly modified Alternative 7 is protective of human health and the environment and provides the best balance among the alternatives with respect to the nine criteria EPA uses to evaluate each alternative. EPA believes that the Selected Remedy would protect human health and the environment, would comply with ARARs, and would be cost effective.

2. Contingent Remedy - Combination Soil Alternative 5A & Dust Alternative 3A

The Contingent Remedy, combination Alternative 5A/3A, incorporates both residential exterior soil and interior lead dust specialized cleaning remedial actions for all homes that qualify for such remediation and in which the homeowners consent to participate. The scope of Superfund includes addressing hazardous substances that pose a threat to human health and the environment resulting from past industrial activities. Therefore, EPA's Contingent Remedy described in this ROD does not and can not specifically address lead-based paint contamination and abatement, which falls outside the scope of Superfund authority. EPA acknowledges that homes in the Borough of Palmerton and within the OU #3 area, as with many homes constructed prior to 1978, may have paint that contains lead. Lead from paint, chips, and dust can pose a serious health hazard if not taken care of properly. However, paint which contains lead poses a hazard only when it is in an exposed and deteriorated condition. Additionally, EPA has determined through extensive investigative and analytical efforts that a very significant majority of lead in interior dust in residences within OU # 3 is present as a result of the track-in of exterior soils contaminated by industrial activities in Palmerton.

a. Eligibility for Remedial Action

The following describes procedures to be followed to determine eligibility of a property for remediation under the Contingent Remedy. Residences within the OU#3 area found to contain exterior soil with lead levels at or above the Site-specific risk-based standard of 650 ppm will be eligible for remediation, the extent of which will be based on residence specific conditions determined through the sampling. Residential property eligible for sampling includes single and multi-family dwellings, apartment complexes, vacant lots in residential areas, schools, daycare centers and playgrounds, parks, and green ways. EPA carefully considered comments received during the public comment period regarding "large undeveloped properties" and has decided that on a case-by-case basis EPA, in consultation with PADEP, will determine if large undeveloped properties zoned residential in close proximity to existing homes will be eligible for cleanup. The determination will be based upon the undeveloped property's proximity to existing residential properties, the potential for re-contamination to occur, the existence (or lack thereof) of preexisting infrastructure for the large undeveloped lot, and any other factors EPA determines would affect the protection of human health and the environment. Any necessary remediation will be the responsibility of the developer of those large undeveloped properties zoned residential but determined not eligible for remediation at such time in the future that the property is developed. Any such remediation must be completed in compliance with all applicable federal and state laws and regulations in effect at that time.

Property owners within the OU #3 area will be solicited to participate in sampling to determine eligibility for remedial action. Regardless of whether EPA or a PRP is conducting the remedial action, EPA personnel will participate significantly in the solicitation process. Appeals for participation will be made through local media outlets, fact sheets, and letters, as well as personal door to door visits, whenever possible. EPA will solicit participation for a limited time, the duration of which will be determined by EPA, in consultation with PADEP. After this solicitation period ends, responsibility for any future remedial actions taken to address lead contamination at a residence will be the individual property owner's responsibility.

b. Sequence of Sampling

If a property owner requests sampling of his/her property, initially, exterior sampling will be performed. A composite sample will be collected from each property. The number of sampling points and their locations which make up the composite sample will be determined by EPA, in consultation with PADEP; but, at a minimum, the composite will be a representative sample from the front and back yard and, if appropriate, side yards and play areas of each residence sampled. Sampling will begin on exterior soils because EPA's risk-based standard is based on exterior soils being the primary source of interior dust contamination.

Residences found to contain exterior soil with lead levels at or above the Site-specific risk-based trigger of 650 ppm will be eligible for remediation, the extent of which will be based on residence-specific conditions determined through the sampling. There will be no age of resident or income eligibility requirements. Children's play areas will be sampled utilizing a separate composite sample from the play area. Play areas for individual residences will be defined during the remedial design process and the number of sampling points and their locations in the play area will be determined by EPA, in consultation with PADEP. Eligibility for the cleanup of play areas only will be based on a composite sample taken from the play area containing lead greater than 400 ppm, the level established by EPA in Subpart D of 40 CFR part 745. Sampling will begin on exterior soils and play areas because EPA's risk-based standard is based on exterior soils being the primary source of industrial interior dust contamination and play areas pose the most direct exposure risk to the most sensitive population. Those residents who qualify will then have the choice to participate in the remedial action, or not. If eligibility sampling finds that a property is eligible for remedial action and the property owner(s) chooses not to participate in the remedial action, some type of institutional control administered cooperatively by the State and local government will need to be implemented to ensure that future buyers of the property are aware of the sampling results for that property.

Those residences which qualify and participate in the exterior soils cleanup will then be eligible for interior dust sampling. Any interior sampling will be conducted after vegetative cover has been established on work done on the exterior to prevent any possibility of re-contamination from the exterior. Interior samples will be collected utilizing hand held HEPA vacuums in living areas until the vacuum cartridge is full of dust. The cartridge will then be analyzed for lead. Residences found to contain interior dust samples with lead levels in their living areas at or above the Site-specific risk-based trigger of 650 ppm will be eligible for remediation.

c. Extent of Soil Remediation

For each residential yard, the exact nature of the remediation will have to be considered on a property-by-property basis and will be based upon the results of samples obtained from the property, as well as the property's unique conditions. In general, the following areas could be eligible to be remediated in each residential yard:

- Sod/lawn areas
- Alleys (if unpaved) to the extension of the lot lines
- Planters, beds, and other landscaped areas
- Garden areas
- Unpaved driveways
- Garages with dirt floors

In short, remediation would occur in any area within and adjacent to the residential yard where residents could potentially come in contact with soils with concentrations above the cleanup levels.

As in the Selected Remedy, the exterior remedial action of the Contingent Remedy will include a combination of actions. Sampling analysis will determine the extent of either soil excavation and/or in-situ treatment of soil which is necessary at a given property in order to achieve the average soil cleanup standard of 650 ppm lead in soil.

Initially, where appropriate, approximately two inches of sod/soil vegetative cover in targeted hot spot or bare areas will be excavated and disposed of off-site in compliance with all applicable regulations. Dust suppression measures will be used during remedial activities. Excavated soil will be replaced with clean soil or a mixture of soil and amendments meeting landscaping specifications. To the maximum extent practicable, the land will be returned to original grade. Although the depth of removal is anticipated to be shallow, underground utilities may have to be marked or cleared prior to excavation and excavation near utilities will have to be undertaken according to established regulations and safety procedures.

Tilling of soil would be accomplished by mixing either pre-amended soil or agricultural-type amendments into the soil. It is anticipated that the mixing will go to a depth of approximately four inches and will include tilling in of agricultural soil amendments, such as mushroom compost, limestone, fertilizer, and/or clean topsoil. Since historical data indicates contaminants are concentrated at the surface, this mixing will reduce the concentration of contaminants.

If necessary, additional clean top soil will be placed to return the land to original grade. Surface re-vegetation will be in the form of hydroseeding with native grasses, mixing grass seed into the soil amendments, or in certain situations, sod could be used. Two weeks of watering will be provided to establish the vegetative cover. A public education and maintenance program will be developed to assist the homeowners in maintenance of the newly-grown vegetative cover. To the maximum extent practicable, yard landscaping will be returned to its original condition. Appropriate air monitoring will be conducted to identify the possible occurrence of contaminant migration during remedial activities. Any exceedance of the standards will result in immediate implementation of additional dust suppression measures or a shutdown of construction activities. Post-remediation composite sampling will be performed to confirm the achievement of remedial action objectives for exterior soils.

Those residences which qualify and participate in the exterior soils cleanup will then be eligible for interior dust sampling. The resident will have the option to have interior sampling done. Any interior sampling would be conducted after vegetative cover has been established on work done on the exterior in an attempt to prevent any possibility of re-contamination from the exterior. Interior samples will be collected utilizing hand held HEPA vacuums in living areas until the vacuum cartridge is full of dust. The cartridge will then be analyzed for lead. Residences found to contain interior dust samples with lead levels in their living areas at or above the Site-specific risk-based trigger of 650 ppm will be eligible for remediation.

For interior hard surfaces, the specialized cleaning is comprised of an initial HEPA vacuuming, then a wet wipe using a substance such as 5% Tri Sodium Phosphate to help remove any lead dust present, then a final HEPA vacuum. For soft surfaces, only HEPA vacuuming is performed. Upholstered and rugged items are vacuumed at a rate of one square yard per minute in two steps, in opposing directions. The specialized cleaning does not include cleaning of decorative or personal effects, closet and cabinet contents, or HVAC interior duct work. If it is apparent that performance standards will not be met by vacuuming carpets alone, EPA, in consultation with PADEP, may decide to remove the affected carpets and reimburse residents for carpet replacement. Hard surfaces beneath removed carpets will be cleaned as described above.

Where cleaning occurs, clearance testing for floors, consistent with Subpart D of 40

CFR Part 745 will be performed after the specialized cleaning to confirm the success of the remedial action. The clearance testing will be performed by a party independent of the person or organization that performed the cleaning. Sampling should occur at least one hour after completion of the specialized cleaning, including cleanup. Remediation of a residence should be accomplished in an average of two days such that only short-term temporary relocation of residents would be necessary.

d. Performance Standards

Each Component of the Contingent Remedy - Combination Alternative 5A/3A - and its Performance Standards are described below.

1. Participation/Solicitation

a. General notification of the solicitation period of the remedial action shall be accomplished through general distribution of fact sheets and via notices in local media outlets.

b. All property owners in the OU #3 area (as defined in this ROD in Section IV, above) shall be contacted to determine their interest in participating in eligibility sampling. Property owner contact shall be verified. The type of verification shall be determined by EPA, in consultation with PADEP, during the remedial design.

c. Properties whose exterior soils were previously addressed under the EPA Interim Removal Action shall not be eligible for sampling.

d. Participation solicitation will be conducted for a limited time, the duration of which will be determined by EPA, in consultation with PADEP. After this solicitation period ends, responsibility for any future remedial actions taken to address lead contamination at a residence will be the individual property owner's.

2. Eligibility Sampling

a. A composite sample will be collected from each property.

b. The number of sampling points and the locations which make up the composite sample will be determined by EPA, in consultation with PADEP; but, at a minimum, the composite will be a representative sample from the front and back yard and, if appropriate, side yards and will exclude drip lines.

c. The analytical method(s) will be determined during the remedial design process but shall, at a minimum, be an EPA-approved method(s). The analytical method(s) will be reviewed and approved by EPA, in consultation with PADEP.

d. Residences found to contain exterior soil with lead levels, as determined by the composite sampling, at or above the Site-specific risk-based trigger of 650 ppm will be eligible for remediation, the extent of which will be based on residence specific conditions determined through the sampling and remedial process.

e. There will be no age of resident or income eligibility requirements for composite sampling eligibility.

f. Sampling results shall be provided to each property owner where sampling is conducted and confirmation that this information has been provided to the property owner shall be provided, consistent with Subpart D of 40 CFR Part 745.

g. If eligibility sampling finds that a property is eligible for remedial action and the property owner(s) chooses not to participate in the remedial action, some type of institutional control administered cooperatively by the State and local government will need to be implemented to ensure that future buyers of the property have notice of the sampling results for that property.

h. The exact nature of the institutional controls will be determined during the remedial design process.

3. Residential play areas

a. Children's play areas will be sampled utilizing a separate composite sample from the residential yard. Play areas for individual residences will be defined during the remedial design process and the number of sampling points and their locations in the play area will be reviewed and approved by EPA, in consultation with PADEP, during the remedial design process.

b. Eligibility for the cleanup of play areas only will be based on lead levels greater than 400 ppm consistent with Subpart D of 40 CFR Part 745.

c. Eligibility for cleanup of play areas shall be independent of eligibility for cleanup of the entire yard.

d. Cleanup of play areas shall be accomplished utilizing the cleanup methods and standards described below in subsection 4 (Exterior Soil Remediation) until a composite clearance sample from the play area confirms that concentrations are below 400 ppm.

4. Exterior Soil Remediation.

a. An average risk-based goal of 650 ppm lead in soil, as determined through composite sampling, shall be applied to exterior soils. Residences found to contain exterior soil with lead levels, as determined by the composite sampling, at or above 650 ppm will be eligible for remediation, the extent of which will be based on residence specific conditions determined through the sampling and remedial process.

b. Remediation of qualifying residential properties shall be accomplished by tilling in either pre-amended soil or agricultural-type amendments, as necessary, and/or excavation, removal, and proper disposal of targeted soils.

1) Areas requiring tilling and/ or targeted excavation and removal shall be determined through either analysis of individual aliquots of the eligibility sampling and/or other sampling methods, as appropriate.

2) The analytical method(s) will be determined during the remedial design process but shall, at a minimum, be EPA-approved method(s). The analytical method(s) will be reviewed and approved by EPA, in consultation with PADEP.

3) Collection and analysis of additional samples may be necessary to determine the most effective area to be tilled or excavated in order to meet the appropriate cleanup goal.

c. Tilling in soil amendments and/or excavation shall continue until the concentration in a post-remediation composite clearance sample falls below the appropriate cleanup standards.

d. The disposal of excavated soil and dust from the Site remediation activities shall be determined by whether or not it passes the TCLP for lead, cadmium, and arsenic. If excavated materials pass the TCLP, they may be disposed of in a non-hazardous waste landfill. If excavated materials do not pass the TCLP, they must be disposed of at a Subtitle C hazardous waste landfill.

1) If the excavated soils are determined to be hazardous wastes the Federal Hazardous Waste Regulations incorporated by PADEP would be applicable for the identification, generation, and handling of hazardous wastes. The applicable portions of these regulations include: 40 CFR 262.11 (hazardous waste determination); 25 PA Code Chapter 262a, subchapter B and incorporated portions of 40 CFR Part 262, Subpart B (manifest); and 40 CFR part 262, Subpart C (pre-tranport requirements); 40 CFR 264.114 subpart G (disposal or decontamination of equipment and structures); 40 CFR 264.171-179 (temporary use and management of containerized waste); 40 CFR 264.251-258 (temporary storage of

containerized waste); and 40 CFR 264.192-194, 197-199 (tank storage).

2) If the excavated soil passes the TCLP then the transfer, storage, and disposal of the waste material must comply with the PADEP Residual Waste Management Regulations which include the following: 25 PA Code Chapter 287 (general provisions for residual waste); 25 PA Code Chapter 299, subchapter A (standards for storage of residual waste) and subchapter B (standards for collecting and transporting of residual waste).

e. Dust control measures shall be implemented during construction in order to comply with fugitive dust regulations in the federally-approved State Implementation Plan for the Commonwealth of Pennsylvania, 25 PA Code §§ 123.1 - 123.2. and the National Ambient Air Quality Standards for Particulate Matter in 40 C.F.R. § 50.6 and PA Code §§ 131.2 and 131.3.
f. Appropriate air monitoring shall be conducted to identify the possible occurrence of contaminant migration during remedial activities.

1) The analytical method(s) will be determined during the remedial design process but shall, at a minimum, be an EPA-approved method(s). The analytical method(s) will be reviewed and approved by EPA, in consultation with PADEP.

2) Any exceedance of the applicable standards shall result in immediate implementation of appropriate corrective measures until such standards are achieved.

g. Sediment and erosion controls and temporary covers will be installed to protect exposed soil from the effects of weather consistent with PADEP's Bureau of Soil and Water Conservation Erosion and Sediment Pollution Control Manual and in accordance with 25 PA Code Chapter 102 (requirements for soil erosion and sedimentation control resulting from earth moving activities). Erosion potential shall be minimized. Further, controls in the form of Site grading to improve land grades, cover soils, vegetation, and drainage channels to reduce erosion potential from surface runoff may be required to minimize erosion. Contaminated soils shall be prevented from being washed into on-Site surface water and adjacent uncontaminated and uncontrolled wetland areas during remedial action implementation. The extent of erosion control necessary will be determined by EPA, in consultation with PADEP, during the remedial design phase.

h. Post-remediation composite sampling shall be performed to confirm the achievement of the appropriate cleanup standards for exterior soils prior to back filling, and/or re-vegetation of disturbed areas.

1) The number of sampling points and the locations which make up the

composite sample will be determined by EPA, in consultation with PADEP; but, at a minimum, the composite will be a representative sample from the front and back yard and, if appropriate, side yards and will exclude drip lines.

2) The analytical method(s) will be determined during the remedial design process but shall, at a minimum, be an EPA-approved method(s). The analytical method(s) will be reviewed and approved by EPA, in consultation with PADEP.

3) The results of the composite clearance sampling shall be provided to the homeowner and confirmation that this information has been provided to the homeowner shall be provided, consistent with Subpart D of 40 CFR Part 745. Should analysis of the composite clearance samples show that the appropriate cleanup standard has been met, the soil cleanup of the property would be complete. Should composite clearance samples not meet the appropriate cleanup standards, additional cleanup measures shall be implemented consistent with subsection a-g, above, until clearance standards are attained and verified via composite sampling.

i. Areas where soil is excavated shall be brought back to original grade using clean topsoil, whenever possible.

j. Reestablishment of vegetation shall be completed on all areas disturbed during soil remediation.

1) Re-vegetation of disturbed areas shall be accomplished by hydroseeding, mixing grass seed with soil amendments, or by use of sod, as appropriate.

2) Two weeks of watering shall be provided to establish the vegetative cover.

3) Public educational materials will be distributed to assist homeowners in maintaining newly-grown vegetative cover.

5. Specialized interior cleanup.

a. Those properties found to be eligible for remedial action under subsection 2. and/or 3., above, will be offered the opportunity to have the living areas of the interior of their homes sampled for interior lead contaminated dust. Any interior sampling will be conducted after vegetative cover has been established on work done on the exterior in an attempt to minimize any possibility of re-contamination from the exterior.

b. The interior dust sampling shall be conducted only with the homeowner's consent. If the homeowner consents, interior samples will be collected utilizing hand held HEPA vacuums in living areas until the vacuum cartridge is full of dust. The cartridge will then be analyzed for lead.

c. The analytical method(s) will be determined during the remedial design process but shall, at a minimum, be an EPA-approved method(s). The analytical method(s) will be reviewed and approved by EPA, in consultation with PADEP.

d. The results of the interior lead dust sampling shall be provided to and discussed with the homeowner and confirmation that this information has been provided to the homeowner shall be provided, consistent with Subpart D of 40 CFR Part 745.

e. Residences found to contain interior dust samples with lead levels in their living areas at or above the Site-specific risk-based trigger of 650 ppm will be eligible for remediation.

f. Short-term, temporary relocation of residents may be necessary during the specialized cleaning. The exact arrangements for relocation shall be determined on a case-by-case basis during the remedial design. EPA, in consultation with PADEP, will review and approve temporary relocation plans for residents during the remedial design process.

g. For interior hard surfaces, the specialized cleaning shall be comprised of an initial HEPA vacuuming, then a wet wipe using a substance such as 5% Tri Sodium Phosphate to help remove any lead dust present, then a final HEPA vacuuming. For soft surfaces, only HEPA vacuuming shall be performed. The specialized cleaning shall not include cleaning of decorative or personal effects, closet and cabinet contents, or HVAC interior duct work. If it is apparent that performance standards will not be met by vacuuming carpets alone, EPA, in consultation with PADEP, may decide to remove the affected carpets and reimburse residents for carpet replacement. Hard surfaces beneath removed carpets will be cleaned as described above.

h. Clearance testing shall be performed after the specialized cleaning consistent with Subpart D of 40 CFR Part 745 for floors to confirm the success of the remedial action. The clearance testing shall be performed by a party independent of the person or organization that performed the cleaning consistent with Subpart D of 40 CFR Part 745.

e. Contingent Remedy Costs

Total present worth costs for Alternatives 5A /3A in the FS and Proposed Plan were listed as $11,121,000. After subsequent evaluation of the FS Report, EPA determined that the actual estimates of present worth costs of Alternatives 5A/3A were approximately $14,883,120. Section XI.B., below, contains a more detailed explanation of the change in reported costs for Alternatives 5A/3A.

In summary, the Contingent Remedy is protective of human health and the environment and would provide the best balance among the alternatives which EPA could implement under CERCLA with respect to the nine criteria EPA uses to evaluate each alternative. Based on the information available at this time, EPA believes the Contingent Remedy would protect human health and the environment, would comply with ARARs, and would be cost effective.

B. Five-Year Reviews

Five-year statutory reviews under Section 121 of CERCLA are required as long as hazardous substances remain on-Site and prevent unlimited use and unrestricted access to the Site. Five-year reviews need not be conducted after either the Selected Remedy or Contingent Remedy is implemented at a property to assure that the remedy continues to protect human health and the environment because neither will leave hazardous substances above cleanup standards in place and both will allow for unlimited use and unrestricted access on residential properties which are addressed. However, if eligibility sampling finds that a property is eligible for remedial action and the property owner(s) chooses not to participate in the remedial action, some type of institutional control administered cooperatively by the State and local government will need to be implemented to ensure that future buyers of the property are notified of the sampling results for that property. In such an instance, Five-year statutory reviews under Section 121 of CERCLA shall be required to ensure that the institutional controls remain effective since hazardous substances above cleanup standards will have been left in place.

A Five-year Review Work Plan shall be required and shall be approved by EPA, in consultation with PADEP.

X. STATUTORY DETERMINATIONS

EPA's primary responsibility at Superfund sites is to select remedial actions that are protective of human health and the environment. Section 121 of CERCLA also requires that the selected remedial action comply with ARARs, be cost effective, and utilize permanent treatment technologies to the maximum extent practicable. The following sections discuss how both the Selected Remedy and Contingent Remedy for the Palmerton Zinc Superfund Site, Operable Unit #3, meets these statutory requirements.

A. Protection of Human Health and the Environment

Based on the BRA for OU #3 at the Site and additional information resulting from the public comment period, measures should be considered to reduce potential risks from lead and arsenic in the residential soils and indoor house dust at the Site. Exposure conditions that may result in unacceptable lead exposure are found in most areas of the Borough. These conditions reflect homes where the average of the soil and dust concentrations is 650 ppm or greater. This finding is the basis for establishing a Site-specific lead cleanup trigger of 650 ppm. Exposure to arsenic may result in cancer risks above 1×10^{-5} but few house-by-house estimates exceed the top of the EPA acceptable risk range (1×10^{-4}). Risk estimates in excess of 1×10^{-4} are associated with exposure concentrations in soil and/or dust of greater than 100 ppm. About 16 percent of HQs for arsenic exposure exceed the target of 1. Areas in the Borough where these concentrations may be exceeded are limited and overlap those where possible lead remediation goals are exceeded.

At residences where lead-based paint as a potential source of interior lead dust contamination can not be positively ruled out by an evaluation/inspection by a state-licensed lead-based paint risk assessor or satisfactorily abated to appropriate clearance levels if risks are found to be present the remediation will need to achieve an average exterior soil cleanup standard of 650 ppm to be protective of human health. At residences where it can be confirmed that lead-based paint is not present, is not a potential source of interior lead dust contamination, or is identified as a risk and satisfactorily abated to appropriate clearance standards, EPA has determined that an average exterior soil cleanup standard of 950 ppm is protective of human health.

EPA is currently preparing a Site-Wide Ecological Risk Assessment for the Palmerton Zinc Superfund Site as part of OU #4. The principal purpose of the Ecological Risk Assessment is to determine the likelihood that biological species habitats in the Site area are exposed to unacceptable risks from Site contaminants. The Ecological Risk Assessment will be incorporated into the OU #4 Remedial Investigation Report which is currently being prepared. Remedial alternatives to address any Site-wide ecological risks identified by the Ecological Risk Assessment will be considered in the OU #4 Feasibility Study. The community will have an opportunity to comment on the RI/FS and Ecological Risk Assessment during the remedy selection process of OU #4.

B. Compliance with and Attainment of Applicable or Relevant and Appropriate Requirements ("ARARs")

The Selected Remedy and the Contingent Remedy will comply with all applicable or relevant and appropriate chemical-specific, location-specific, and action-specific ARARs. Those ARARs are:

1. Chemical Specific ARARs

The Commonwealth of Pennsylvania has promulgated standards for soil cleanup under The Land Recycling and Remediation Standards Act (Act 2); 25 PA Code Chapter 250, Administration of the Land Recycling Program, for remediation efforts conducted in Pennsylvania. The EPA exterior soil cleanup standards, determined through a baseline risk assessment, complies with 25 PA Code Chapter 250, subchapter D (site specific standards) and subchapter F (exposure and risk determination).

Disposal of contaminated soil is subject to land disposal restrictions ("LDR") when it contains a listed hazardous waste or when it exhibits a characteristic of a hazardous waste (63 FR 28602, May 26, 1998). Based upon current EPA guidance, soil and dust removed from residential properties in OU #3 is not considered to contain the RCRA listed waste K061 and is therefore not subject to RCRA requirements, including LDRs.

The method of disposal of excavated soil and dust from the Site remediation activities will be determined by whether or not it passes the TCLP for lead, cadmium, and arsenic. If excavated materials pass the TCLP, they may be disposed of in a non-hazardous waste landfill. If excavated materials do not pass the TCLP, they must be disposed of at a Subtitle C hazardous waste landfill.

2. Location Specific ARARs

The Pennsylvania Erosion Control Regulations, 25 PA Code §§ 102.1 - 102.5, 102.11 - 102.13, and 102.21 -102.24, regulate erosion and sedimentation control. These regulations are applicable to the grading and excavation activities associated with the Selected Remedy and the Contingent Remedy.

If the excavated soils are determined to be hazardous wastes the Federal Hazardous Waste Regulations incorporated by PADEP would be applicable for the identification, generation, and handling of hazardous wastes. The applicable portions of these regulations include: 40 CFR 262.11 (hazardous waste determination); 25 PA Code Chapter 262a, subchapter B and incorporated portions of 40 CFR Part 262, Subpart B (manifest); and 40 CFR part 262, Subpart C (pre-tranport requirements); 40 CFR 264.114 subpart G (disposal or decontamination of equipment and structures); 40 CFR 264.171-179 (temporary use and management of containerized waste); 40 CFR 264.251-258 (temporary storage of containerized waste); and 40 CFR 264.192-194, 197-199 (tank storage).

If the excavated soil passes the TCLP then the transfer, storage, and disposal of the waste material must comply with the PADEP Residual Waste Management Regulations which include the following: 25 PA Code Chapter 287 (general provisions for residual waste); 25 PA Code Chapter 299, subchapter A (standards for storage of residual waste) and subchapter B (standards for collecting and transporting of residual waste).

Dust control measures shall be implemented during construction in order to comply with fugitive dust regulations in the federally-approved State Implementation Plan for the Commonwealth of Pennsylvania, 25 PA Code §§ 123.1 - 123.2. and the National Ambient Air

Quality Standards for Particulate Matter in 40 C.F.R. § 50.6 and PA Code §§ 131.2 and 131.3.

The Storm Water Management Act of October 4, 1978, P.L. No. 167, as amended , 32 P.S. Section 680.13., is applicable with respect to control of storm water runoff during construction.

The National Historic Preservation Act of 1986, 16 U.S.C. § 470 (Chapters 106 and 110(f), and 36 CFR part 800) and the Archeological and Historic Preservation Act of 1974 (16 U.S.C. § 469a-1) are applicable to the exterior soil excavation portions of the Selected Remedy and the Contingent Remedy as they would apply to properties on the National Historic Register.

The Selected Remedy and the Contingent Remedy shall comply with the applicable substantive requirements of theses statutes.

3. Action Specific ARARs

Fugitive dust emissions generated during remedial activities will be controlled in order to comply with fugitive dust regulations in the federally-approved State Implementation Plan for the Commonwealth of Pennsylvania, 25 PA Code §§ 123.1 - 123.2. and the National Ambient Air Quality Standards for Particulate Matter in 40 C.F.R. § 50.6 and PA Code §§ 131.2 and 131.3.

Sediment and erosion controls and temporary covers will be installed to protect exposed soil from the effects of weather consistent with PADEP's Bureau of Soil and Water Conservation Erosion and Sediment Pollution Control Manual and in accordance with 25 PA Code Chapter 102 (requirements for soil erosion and sedimentation control resulting from earth moving activities).

Although the OSHA standards governing worker safety during hazardous waste operations set forth at 29 C.F.R. Parts 1910, 1926, and 1904 are not ARARs, they must be complied with during all Site work .

B. To Be Considered ("TBC") Standards

EPA has issued regulations under Section 403 of the Toxic Substances Control Act, as amended by the Residential Lead-Based Paint Hazard Reduction Act of 1992, also known as "Title X." These regulations establish standards for lead hazard evaluations, residential lead dust cleanup levels, dust and soil sampling requirements, and dust clearance standards, among other things. While EPA does not have authority under Superfund to address lead-based paint, the Selected Remedy provides for evaluation and remediation of lead-based paint, in some circumstances. Therefore, the regulations in 40 C.F.R. Subpart D would be helpful in determining the effectiveness of the cleanup and in establishing the criteria to be used in the evaluation, cleanup, and clearance sampling required by the Selected Remedy. For example, 40 C.F.R. §§ 745.63 and 745.65 provide useful definitions, including the definition of play area and lead-based paint hazards; 40 C.F.R. §§ 745.220 and 745.226 provide standards for certifying lead-based paint risk assessors and contractors; and 40 C.F.R. §§ 745.223 and 745.227 establish standards for determining when abatement of lead-paint has occurred and for clearance sampling to determine whether the abatement was successful. Therefore, the regulations in 40 C.F.R. Part 745, Subpart D are standards which, while not applicable, will be considered in this action if the Selected Remedy is implemented.

C. Cost-Effectiveness

Both the Selected Remedy and the Contingent Remedy are cost-effective in providing overall protection in proportion to cost and meet all other requirements of CERCLA. Section 300.430(f) (ii) (D) of the NCP requires EPA to evaluate cost-effectiveness by comparing all the alternatives which meet the threshold criteria - protection of human health and the environment and compliance with ARARs - against three additional balancing criteria: long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; and short-term effectiveness. Both the Selected Remedy and the Contingent Remedy meet these criteria and provide for overall effectiveness in proportion to their cost. The combined estimated present worth cost estimate for Alternative 7, as provided by Viacom for the Feasibility Study, is $13,656,000. However, based on the modifications to Alternative 7, as described in the discussion of the Selected Remedy, the estimated costs may increase slightly due to the potential that a slightly larger than estimated number of homes will qualify for exterior remediation. The exact amount of the increase in cost is impossible to predict until actual eligibility sampling activities are well underway but is expected to be minimal. Total present worth costs for the Contingent Remedy, Alternatives 5A /3A in the Feasibility Study and Proposed Plan were listed as $11,121,000. After subsequent evaluation of the FS Report, EPA determined that the actual estimates of present worth costs of Alternatives 5A/3A should be approximately $14,883,120. See Section XI.B. below, for a more detailed explanation of the change in reported costs for Alternatives 5A/3A.

D. Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable

EPA has determined that the Selected Remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized while providing the best balance among the other evaluation criteria. Of those alternatives evaluated that are protective of human health and the environment and meet ARARs, the Selected Remedy provides the best balance of tradeoffs in terms of long-term and short-term effectiveness and permanence, cost, implementability, reduction in toxicity, mobility, or volume, through treatment, State and community acceptance, and preference for treatment as a principal element.

Under the Selected Remedy, inspection for and, if necessary, abatement of lead-based paint risks, in combination with HEPA vacuuming of living spaces until appropriate clearance standards are met, provides a high degree of long-term effectiveness and permanence, reduces mobility, and reduces risk to human health and the environment with regard to interior dust.

Under the Contingent Remedy, the interior dust specialized cleaning is protective of human health and the environment and would provide, if the Selected Remedy is not used, the best balance among the alternatives which EPA could implement under CERCLA with respect to the nine criteria EPA uses to evaluate each alternative. Based on the information available at this time, EPA believes the Contingent Remedy would protect human health and the environment, would comply with ARARs, and would be cost effective.

In both the Selected Remedy and the Contingent Remedy, selection of excavation and offsite disposal of contaminated soils and tilling in soil amendments as components of the remedy provides the best balance of trade offs among the nine NCP selection criteria. Both the Selected Remedy and the Contingent Remedy provide a high degree of long-term effectiveness and permanence, reduce mobility, and reduce risk to human health and the environment with regard to exterior soil.

E. Preference for Treatment as a Principal Element

Both the Selected Remedy and the Contingent Remedy satisfy, in part, the statutory preference for treatment as a principal element. The contaminated exterior soil in-situ treatment via tilling in pre-amended soil and/or soil amendments addresses the future ingestion of contaminated soil above unacceptable levels by reducing the contaminants concentration through treatment.

XI. DOCUMENTATION OF CHANGES FROM PROPOSED PLAN

A. Reevaluation of BRA Based on Comments Received on Proposed Plan

As discussed above, an attempt was made to correlate the relationship between contamination in soil and contamination in interior dust in the BRA for OU #3. Since both these media contribute to exposure and the ultimate risk, EPA attempted to use their correlation to aid in the calculation of meaningful remediation goals for lead at the site. With a slope of 0.22, the lead-specific regression analysis conducted in the BRA revealed a soil-to-dust transfer rate of 22 percent. However, the very high intercept value predicted by this statistical assessment seemed implausible, yielding an artificially low soil remediation goal. (Note that the intercept value theoretically represents baseline lead levels in interior dust.) As a consequence, the results of the regression analysis were abandoned. Instead, the entire CDM analytical data sets for lead in soil and for lead in dust were graphed, with the number of observations plotted against concentration. The two plots overlapped almost exactly, strongly suggesting a 1:1 correlation between lead in soil and lead in interior dust in Palmerton Borough. This assumption resulted in respective cleanup goals of 650 mg/kg for each medium (soil and dust). These remediation levels were based on the IEUBK Model, as it was applied in the BRA for OU #3. Details of this regression analysis for lead can be found on page 5-23 and in Figure 5-14 of the BRA .

The extreme relative differences in the soil-to-dust transfer rates of other metals associated with the Site versus the coefficient assumed for lead (100 percent) was troubling. This discrepancy among metals prompted Region III to request statistical support from EPA's NERL subsequent to issuance of the Proposed Plan for OU #3 . After discarding obvious outliers from the data set -- that is, interior dust levels greater than 1000 mg/kg *and* at least twice the observed soil concentrations for a given property -- a regression analysis performed by NERL suggested a mean soil-to-dust transfer rate of 33 percent for lead. This was consistent with the transfer rates observed by NERL for other metals at the Site (arsenic = 31 percent, cadmium = 29 percent, and zinc = 32 percent). The 95th percent UCL of the mean transfer rate for lead was calculated to be 41 percent. More technical information regarding the cited statistical analyses is presented in a report prepared by NERL to Region III (February 2001) and is included in the Administrative Record for OU #3.

Due to possible uncertainties in the soil and dust data sets, as well as in the regression analysis, Region III recalculated remediation goals for lead using the conservative estimate of the mean transfer rate, 41 percent. Applying the same exposure assumptions as in the BRA, the IEUBK Model indicated that with a soil-to-dust transfer rate of 41 percent, an average cleanup level of 950 mg/kg for lead in soil would be protective. The underlying premise associated with this remediation goal is that no other predominant sources of lead exposure exists (i.e., lead-based paint). Consequently, the inherent protectiveness of using this cleanup level is contingent upon the abatement of lead-based paint at impacted residences.

B. Correction of Costs for Interior Cleanup and Overall Costs for Alternative 5A/3A

The total present worth costs for Alternative 5A in the May 2000 Final Feasibility Study and also in the June 2000 Proposed Plan were incorrectly listed as $11,121,000. These costs were incorrectly calculated based on exterior soil cleanup and interior dust cleaning costs associated with Alternative 3 for 778 properties in the Palmerton Borough and 778 properties for interior cleanup outside the Borough. The estimate of properties potentially eligible for interior cleanup under Alternative 3 outside the Borough is actually 252, as was correctly reflected in the discussion in Appendix A of the FS. Following issuance of the Proposed Plan, EPA identified this error. The correct present worth costs based on exterior soil cleanup under Alternative 5A and interior dust cleaning costs associated with Alternative 3 for 778 properties in the Palmerton Borough and 252 properties outside the Borough is $10,710,00. A revised summary cost table is provided as Table 3 which reflects this correction for each alternative.

In addition, the total present worth costs for the Preferred Alternative in the June 2000 Proposed Plan was listed as $11,121,000 and was based on the exterior soil cleanup and interior dust cleanup of a total of 1030 properties utilizing Alternatives 5A/3. In order to be conservative regarding potential costs, the total present worth costs should have also included the costs of Interior Dust Alternative 3A. The costs of Alternative 3A were calculated assuming that no more than 2/3 of homes eligible for interior cleanup under Alternative 3 would required carpet removal and replacement. The total present worth for Alternative 3A is $4,173,120. Therefore, the conservative present worth costs for the Preferred Alternative should have been:

> Revised FS costs for Alternatives 5A/3, assuming 778 residences in Palmerton and 252 outside the Borough - $10,710,000
> Cost of carpet replacement and cleaning of 690 residences- $ 4,173,120
> Total Present Value Costs- $14,883,120

This total is conservative because it is not expected that every eligible interior would receive both the specialized cleaning described in Alternative 3 and the carpet replacement and cleaning described in Alternative 3A.

PRP Alternative 7 costs, as modified in the Selected Remedy, could potentially increase due to the reduction in cleanup standard from 1050 ppm, as proposed in PRP Alternative 7, to 950 ppm, as calculated by EPA and by eliminating the preference for relying on existing vegetative cover for protectiveness. However, it is impossible to determine exactly how much additional costs would be incurred until eligibility sampling occurs and the universe of homes to be remediated is determined. EPA anticipates that the costs of the Selected Remedy will not be significantly greater than the original Alternative 7 costs estimate of $13,656,000 and would likely be slightly less costly than the Contingent Remedy due to the potential that fewer properties will require exterior soil remediation to meet the 950 ppm average cleanup goal if lead-based paint is eliminated as a potential risk.

C. Change in Evaluation of Eligibility of "Large Undeveloped Properties"

EPA has carefully considered comments received regarding "large undeveloped properties" and has decided that on a case-by-case basis EPA, in consultation with PADEP, will determine if large undeveloped properties zoned residential in close proximity to existing homes will be eligible for cleanup. The determination will be based upon the undeveloped property's proximity to existing residential properties, the potential for re-contamination to occur on adjacent residential properties, the existence (or lack thereof) of preexisting infrastructure for the large undeveloped lot, and any other factors which EPA determines would affect the protection of human health and the environment.

D. Addition of Play Area Sampling and Remediation

The addition of eligibility sampling and potential cleanup of play areas, if necessary, is based on consistency with EPA's regulations under Section 403 of the Toxic Substances Control Act, as amended by the Residential Lead-Based Paint Hazard Reduction Act of 1992, also known as "Title X." The sampling of play areas and potential cleanup to 400 ppm average lead ensures that children, the portion of the population most at risk from elevated lead levels, are protected in the areas where they are most likely to spend significant amounts of time. This aspect of the Selected Remedy and the Contingent Remedy was not included in the Proposed Plan because these regulations were issued after the Proposed Plan was released and after the end of the public comment period.

E. Addition of Arsenic Clearance Sampling

Clearance sampling for arsenic was added to the Selected Remedy to verify the assumptions made in EPA's BRA relating to the relative distribution of elevated lead and arsenic levels in the community and to ensure protectiveness of the remedy with regard to arsenic in situations where the exterior soil cleanup standard of 950 ppm is applied.